REMEDIAL ACTION PLAN

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REMEDIAL ACTION PLAN

Pfizer – Carolina Facility
Carolina, Puerto Rico

Submitted to: Pfizer Inc.
Route 206 North
Peapack, NJ 07977 USA

Submitted by: Golder Associates Inc.
9428 Baymeadows Road, Suite 400
Jacksonville, FL 32256 USA

Distribution:

1 Copy	Pfizer, Inc. (electronic)
1 Copy	Golder Associates Inc.

May 2014 **103-82746.A**

Table of Contents

List of Tables

List of Figures

List of Appendices

1.0 INTRODUCTION

Golder Associates Inc. (Golder) has prepared this Remedial Action Plan (RAP) for Pfizer Inc. (Pfizer) to address impacted groundwater and soil at the Pfizer facility located in Carolina, Puerto Rico (the site). Based on the results of site assessment activities conducted by Golder from September 2010 through December 2013, chlorinated hydrocarbons (primarily trichloroethene [TCE] and its associated biodegradation products) are present at the site in groundwater at concentrations above the United States Environmental Protection Agency (EPA) Maximum Contaminant Levels (MCLs). While some of the TCE originates onsite, there appears to be a contribution of tetrachloroethene (PCE) and, to a lesser extent, TCE from offsite and upgradient source(s), with the source of the PCE potentially originating from an upgradient (offsite) source. Chlorinated hydrocarbons are also present in unsaturated soils, but to a much lesser extent.

The objective of this RAP is to present a remedial strategy that will mitigate exposure pathways (risk) to the chlorinated hydrocarbons in soil and groundwater to support a No Further Action determination. The remedial strategy involves implementation of an in-situ treatment system (injections) to remove (treat) chlorinated hydrocarbons through enhanced biodegradation in shallow source area groundwater, within the core of the plume, and along the downgradient property boundary. The goal of this strategy would be to enhance and accelerate the natural degradation processes that are actively occurring at the site, in order to stabilize and shrink the impacted groundwater plume and mitigate the potential offsite migration of chlorinated hydrocarbons. Previous investigations have indicated that no active water supply wells are located within one-half mile of the site; however, a potential for exposures may exist at an undocumented or downgradient water supply well, even though the area is serviced by municipal water. Nevertheless, Pfizer will place groundwater use restrictions in the Deed to prevent future onsite use for potable purposes.

Injections to enhance biodegradation will continue until such time that they will no longer efficiently accelerate the rate of biodegradation and monitored natural attenuation can achieve the remedial objectives. A field test will be performed prior to full-scale implementation of this RAP to evaluate the effectiveness of the treatment, determine the preferred amendment delivery mechanism, and refine site-specific design parameters and estimated remedial costs.

This RAP includes a general overview of the project, site background information, including summaries of previous soil and groundwater investigations, a remedial alternatives evaluation, the selected remedial approach with appropriate design specifications, monitoring and evaluation criteria, and remedial cost estimates and schedule. Contingent soil remedies may be enacted if a significant source is encountered during implementation of the groundwater remedy. This RAP has been developed at the direction of and for Pfizer.

2.0 BACKGROUND

2.1 Site Location and Description

The site is located at Kilometer 9.7 of 65th Infantry Avenue, Carolina, Puerto Rico and is situated on the northeastern portion of the island, roughly 10 kilometers southeast of the San Juan airport and eight kilometers south of the Atlantic Ocean. The coordinates for the site are approximately 18 degrees, 22 minutes, 55 seconds north latitude and 65 degrees, 57 minutes, 59 seconds west longitude. The site location and its general topographic features are shown on Figure 1.

The site consists of 20.33 acres of land and is located in a mixed-use commercial and industrial area. The site is bounded on the north by 65th Infantry Avenue followed by various commercial businesses; on the west by an unnamed road followed by a vacant lot; on the south by State Road PR-887 followed by warehouses, a supermarket, and a government building; and on the east by various restaurants and a furniture store.

Prior to site demolition activities conducted in the summer of 2013, building structure footprints occupied approximately 545,374 square feet (60 to 65% of the site). Currently, three buildings (Buildings A, B, and F) remain onsite and occupy an approximate footprint of 30,000 square feet. Building foundations that were removed in 2013 have now been backfilled, graded, and seeded with temporary erosion and sediment control features. The remainder of the site is in pre-demolition condition and is occupied by asphalt or concrete paved surfaces and landscaped areas. A retention pond for storm water control remains in place in the northern portion of the site and occupies approximately 19,000 square feet. The current site plan is presented on Figure 2. The previous site plan and building information can be found in Appendix A.

2.2 Historical, Current, and Future Land Use

The original plant was built around 1956 or 1957 for Parke Davis & Company (Parke Davis) to be used as a pharmaceutical manufacturing facility. The facility was owned and operated by Parke Davis from 1956 to 1974. The facility was purchased by Lederle Laboratories, a division of American Cyanamid Company, in 1974, which operated it as a pharmaceutical manufacturing facility until 1994. In 1994, American Home Products took over the facility and operated it until 2002. From 2002 to October 2009, Wyeth Ayerst Lederle, Inc. (Wyeth), a successor to American Home Products, ran the facility. Wyeth was acquired by Pfizer on October 15, 2009.

Under Pfizer, the facility manufactured an injectable antibacterial combination product consisting of the semi-synthetic antibiotic piperacillin sodium and the ß-lactamase inhibitor tazobactam sodium for intravenous administration, and an injectable tetracycline-class antibacterial used for the treatment of skin and intra-abdominal infections, and community-acquired bacterial pneumonia. The site contained 11 primary building structures (Buildings A, B, C, D, E, F, G, H, I, J, and M) that were used for various purposes, including office space, manufacturing, packaging, engineering and maintenance, utilities (chillers, boilers, and emergency generators), laboratory space, storage, and support areas.

Plant operations were discontinued and site demolition began in 2013 as described in Section 2.1. Currently, two of the eleven building structures remain (Buildings A and B) due to regulatory complications arising from their alleged historical and architectural significance. The security guard house (Building F) also remains. The site is currently for sale.

2.3 Summary of Previous Assessment and Remedial Activities

In 2010, Pfizer retained Golder to conduct a Divestiture Environmental Site Assessment (DESA) for the purpose of evaluating the potential for environmental impacts as a result of past and current activities on the property. The discoveries detailed in the DESA led to a preliminary subsurface investigation in September 2010 as requested by Pfizer. Samples collected from soil borings/temporary well points indicated that chlorinated hydrocarbons were present in groundwater at the site at concentrations above MCLs. From September 2010 through December 2013, Golder conducted site assessment activities to further delineate the groundwater impacts and investigate soil conditions for potential sources(s), including additional soil and groundwater grab sampling from soil borings/temporary well points and soil gas sampling. A total of 15 shallow monitoring wells (MW-01S through MW-15S) and three deeper monitoring wells (MW-02D, MW-03D, and MW-07D) were installed across the site and sampled from 2010 through 2013. Sampling results from these investigations indicated that chlorinated hydrocarbons were present in the vicinity of the former locations of Building D and Building E, and, to a lesser extent, west of the former location of Building G. Also, results indicated there is potential contribution to the onsite chlorinated solvent contamination from an offsite source located upgradient (south) of the site. The results of these investigations are summarized in Section 3.0 and Section 4.0 of this report.

2.4 Physical Setting

2.4.1 Topography

The ground surface at the site slopes downward from the southeast corner of the site [approximate ground surface elevation of 66 feet above mean sea level (msl)] to the northwest corner of the site (approximate ground surface elevation of 33 feet above msl).

2.4.2 Hydrology

The closest surface water body to the facility is an unnamed tributary of the Blasina Creek, which is located approximately 0.3 miles northwest of the site. The Rio Grande de Loiza is located approximately 0.56 miles southeast of the site. This river flows to the northeast and ultimately discharges into the Atlantic Ocean, approximately five miles north of the site. Blasina Creek is located approximately 0.7 miles northwest of the site and flows northward towards Laguna La Torrecilla, which ultimately discharges into the Atlantic Ocean.

2.4.3 Geology

According to the USGS 1977 Geologic Map of the Carolina Quadrangle, Puerto Rico, the geological formations at the site are part of the Frailes formation (upper cretaceous series), which consist of grayish-green medium to very thick-bedded volcanic stone, partially pebbly, and fine to medium volcanic breccia with a thickness of 700 to 800 meters.

Based on soil samples and drill cuttings that were logged during soil boring advancements and monitoring well installations, the lithology underlying the site is heterogeneous. A layer of fine sand with varying amounts of silt intermixed with discontinuous clay seams was observed to a depth of approximately 20 to 30 feet below ground surface (bgs) on the eastern portion of the site and to a depth of approximately 40 feet bgs on the western portion of the site. Boulders and weathered volcanic rock fragments were encountered in some of the borings at varying depths between 5 to 20 feet bgs. The sand layer observed in the eastern portion of the site was very dense and compact. The sand layer observed on the western portion of the site was less compact and was flowing within the hollow stem augers upon installation of monitoring wells MW-04S and MW-05S.

Underlying the sand layer, weathered and fractured volcanic rock was observed across the site. Based on previous investigations, the weathered rock was encountered on the eastern portion of the site at approximately 20 to 30 feet bgs and on the western portion of the site at approximately 50 feet bgs. In the center of the site, the rock was encountered at approximately 15 to 30 feet bgs in the northern portion of the site and approximately 50 to 60 feet bgs towards the southern portion of the site.

Four geologic cross sections (A – A', B – B', C – C', and D – D') were constructed using lithologic information obtained from soil boring and monitoring well construction logs, soil boring ground surface elevations or top of monitoring well casing elevations relative to mean sea level, monitoring well groundwater elevation data, and laboratory analytical data from various borings and monitoring wells at the site. The cross sections are presented in Appendix B.

2.4.4 Hydrogeology

According to the Atlas of Ground-Water Resources in Puerto Rico and the US Virgin Islands (USGS, 1996), the area in the general vicinity of San Juan and Carolina is identified as the Bayamón-Loiza Region. There are two principal water-bearing units in this region: an upper water-table aquifer comprised of sedimentary rocks of Tertiary Age and superficial deposits of Quaternary age; and a lower confined aquifer comprised mainly of sedimentary rocks of Tertiary age. The two units are separated by the upper member of the Cibao Formation, which acts as a confining unit; however, this formation is not located in the vicinity of the site based on the USGS 1977 geologic map of the Carolina quadrangle. Within the more immediate vicinity of the site and to the south towards Trujillo Alto groundwater can be found in small quantities from the volcanic rock underlying overburden deposits. The water that may be available in the volcanic bedrock flows through cracks and fissures in the weathered zones.

Based on observations made during soil boring advancements and monitoring well installations, groundwater is present at the site in two water bearing zones: an unconfined, surficial zone within the overburden silty sand layer, and a semi-confined zone within the cracks and fissures of the weathered volcanic rock. Monitoring wells screened in the overburden material indicate that the depth to groundwater in the surficial zone typically ranges from less than one foot bgs to approximately six feet bgs towards the western portion of the site and from approximately 10 to 20 feet bgs towards the central and eastern portions of the site.

At the locations of monitoring wells MW-01S, MW-02S, and MW-07S, groundwater was not encountered in the overburden material. As a result, the monitoring wells at these locations were advanced into the weathered volcanic rock and screened as water bearing zones were encountered, which typically ranged from approximately 30 feet bgs towards the central portion of the site (MW-02S and MW-07S) to 60 feet bgs towards the eastern portion of the site (MW-01S). Monitoring wells were not installed in the weathered volcanic rock towards the western portion of the site. Groundwater was also encountered at deeper intervals within the weathered rock at depths ranging from approximately 70 feet bgs (MW-03D) to approximately 90 feet bgs (MW-07D).

3.0 SOIL ASSESSMENT SUMMARY

From September 2010 to December 2013, 61 soil borings were advanced to depths ranging from 5 feet bgs to 60 feet bgs at the site. In general, soil from each boring was screened in the field for soil headspace volatile organic compounds (VOCs), at 1-foot or 2-foot intervals, with an organic vapor analyzer equipped with a photo-ionization detector. In general, elevated soil headspace screening results were detected in soil collected beneath the former lyophilizers areas of Building D and the former Parenterals III Building at depths between 18 feet and 28 feet bgs. A summary of the soil headspace screening results from the 2013 soil borings is presented in Table 1.

Soil samples were collected from points representing the highest soil headspace screening results and/or indications of impacts (visual and olfactory) from select boring locations and submitted for laboratory analysis of chlorinated VOCs. The analytical results from the soil samples collected from September 2010 to December 2013 indicated that VOCs were detected at the site at concentrations above laboratory method detection limits; however, the concentrations were not above the US Environmental Protection Agency (EPA) November 2013 regional screening levels (RSLs) for industrial soil. The analytical results were also below the associated carcinogenic screening levels for an inhalation exposure pathway. As a result, a significant residual source within the vadose zone at the site has not been identified nor appears to exist, based on the extensive distribution of soil test borings in the area with groundwater impacts. Soil boring locations are presented on Figure 3. Soil analytical results are presented in Table 2 and depicted on Figure 4.

Vadose zone soil contaminant mass calculations were performed using chlorinated VOC concentrations of the samples collected from six soil borings (TB-41, TB-43, TB-48, TB-49, TB-52, and TB-54) located in the vicinity of the former lyophilizers areas of Building D. These soil borings were the only borings where chlorinated VOCs were reported above laboratory method detection limits. Based on an approximate surface area of approximately 9,800 square feet in this area and an estimated contaminant thickness of 10 feet, approximately 12 pounds of residual chlorinated VOCs were estimated to remain in the vadose zone at the site. Soil contaminant mass calculations can be found in Appendix C.

4.0 GROUNDWATER ASSESSMENT SUMMARY

Concurrent with the soil investigation, groundwater grab samples were collected from select soil borings from September 2010 to December 2013 to further characterize groundwater conditions at the site. Groundwater grab samples were predominantly collected in the vicinity of and downgradient of potential source areas near the former lyophilizers in Building D and the former Parenterals III addition. Groundwater grab samples were collected from the shallow (uppermost) surficial saturated zone. In addition, a total of 15 shallow monitoring wells (MW-01S through MW-15S) and three deeper monitoring wells (MW-02D, MW-03D, and MW-07D) were installed and sampled at the site to characterize the horizontal and vertical extent of the chlorinated hydrocarbon impacts at the site and to obtain site-specific geochemical information.

4.1 Groundwater Elevations

The depth to groundwater measurements and calculated groundwater elevations for the 2013 monitoring event and historical monitoring events are summarized in Table 3. A potentiometric map based on the groundwater elevation data collected in December 2013 is shown on Figure 4. Based on December 2013 data, the groundwater flow direction is towards the north (to the Atlantic Ocean), which is consistent with historical data and the distribution of VOCs in groundwater.

4.2 Hydrogeologic Characterization

Vertical hydraulic gradients were calculated using the groundwater elevation data collected on October 17, 2011 to evaluate if vertical groundwater flow conditions exist at the site. The vertical gradients were calculated by observing the groundwater elevation difference at adjacent wells (well clusters) over the distance between the center-of-screen elevations. Using these data, vertical gradients were calculated between the shallow wells and the deeper wells for monitoring well clusters MW-02S/MW-02D, MW-03S/MW-03D, and MW-07S/MW-07D. The results indicated slight upward gradients of -0.026 feet per foot (ft/ft) at the MW-02S/MW-02D well cluster, -0.0072 ft/ft at the MW-03S/MW-03D well cluster, and -0.028 ft/ft at well MW-07S/MW-07D well cluster. The calculations were also performed using groundwater elevation data from the September 12, 2012 monitoring event. The results were similar to those observed for October 2011. The vertical hydraulic gradient calculations are provided in Appendix D.

On September 19 and 20, 2012, well-specific hydraulic conductivity (slug) testing was conducted at selected monitoring wells to aid in evaluating the hydraulic characteristics of the shallow and relatively deeper hydrostratigraphic intervals. Testing was performed at monitoring wells MW-02S, MW-02D, MW-03S, MW-03D, MW-07S, MW-07D, and MW-08S using a pressure transducer and electronic data logger. Golder evaluated the data using the Bouwer & Rice Method. The test data for MW-07S and MW-08S were found to have insufficient head differential to provide meaningful results; therefore, the data for these wells were not used to calculate hydraulic conductivity. The hydraulic conductivity geometric mean for the shallow zone groundwater and the deeper zone groundwater are 10.8 feet per day (3.82 x 10^{-3} cm/sec) and 6.7 feet per day (2.47 x 10^{-3} cm/sec), respectively. A summary of the hydraulic conductivity test results is presented in Appendix D.

Horizontal hydraulic gradients were calculated using the December 2013 groundwater elevation data for the shallow and deeper zone groundwater at the site. The horizontal hydraulic gradient in the shallow zone groundwater was calculated using monitoring wells MW-02S, MW-07S, and MW-12S and was found to be 0.012 ft/ft. The horizontal hydraulic gradient in the deeper zone groundwater was calculated using monitoring wells MW-02D, MW-03D, and MW-07D and was found to be 0.008 ft/ft. The horizontal hydraulic gradient calculations are provided in Appendix D.

The calculated average linear velocity of groundwater flow in the shallow zone groundwater at the site is estimated to be approximately 189 feet per year (ft/yr), based on an average hydraulic conductivity of 10.8 ft/day and a horizontal hydraulic gradient of 0.012 ft/ft. The calculated average linear velocity of groundwater flow in the deeper zone groundwater is estimated to be approximately 33 ft/yr, based on an average hydraulic conductivity of 6.7 ft/day and a horizontal hydraulic gradient of 0.008 ft/ft. The flow velocities are based on an estimated effective porosity of 25 percent for fine sand and 60 percent for weathered volcanic rock (Fetter, 1994). The average linear velocity calculations are provided in Appendix D.

4.3 Groundwater Analytical Summary

Analytical results from the groundwater grab sampling events from September 2010 to December 2013 are presented in Table 4. Groundwater analytical results from the site monitoring wells are presented in Table 5. VOC concentrations for shallow zone groundwater and deeper zone groundwater are presented on Figure 6 and Figure 7, respectively. Groundwater concentration contour maps were created for select chlorinated hydrocarbons using both historical groundwater grab sampling results and the results from the December 2013 monitoring well sampling event. The contour maps for PCE, TCE, total 1,2-dichloroethene (1,2-DCE), and vinyl chloride are presented on Figures 8, 9, 10, and 11, respectively.

4.3.1 Shallow Zone Groundwater

As discussed in Section 1.0, there appears to be a contribution of PCE and, to a lesser extent, TCE from offsite and upgradient source(s), with the source of the PCE potentially originating from this upgradient and offsite source. Given that both PCE and TCE are both common solvents used for various industrial purposes, TCE often exists as a separate source from PCE. PCE can also serve as a parent biological degradation compound for several other chlorinated solvent compounds, including TCE, cis-1,2-DCE, and vinyl chloride. However, based on the differences in distribution of PCE and TCE in shallow zone groundwater as discussed below, the majority of the TCE appears to originate from an onsite source.

The highest PCE concentration reported in the shallow zone groundwater monitoring wells was 133 micrograms per liter (µg/L) in the October 2011 groundwater sample collected from monitoring well MW-03S. In December 2013, PCE was reported above the MCL of 5 µg/L in the groundwater samples collected from shallow monitoring wells MW-03S (132 µg/L), MW-08S (10.9 µg/L), MW-10S (29.7 µg/L), and MW-12S (28.3 µg/L). In addition to the monitoring well samples, several of the groundwater grab samples collected from September 2010 to December 2013 also exhibited PCE concentrations above the MCL. The highest concentrations of PCE were observed west and northwest of former Building D at borings TW-4 (88.4 µg/L) and TW-5 (55.1 µg/L), respectively.

The highest concentrations of TCE and its degradation by-products (cis-1,2-DCE and vinyl chloride) were observed in groundwater from monitoring well MW-13S (near the vicinity of the former lyophilizer in Building D). TCE, cis-1,2-DCE, and vinyl chloride concentrations were observed at 3,510 µg/L, 2,610 µg/L, and 429 µg/L, respectively. These constituents were observed at concentrations above MCLs in groundwater from other monitoring wells across the site, as shown on Figure 6. The only other constituent of concern (COC) observed at a concentration above its MCL was 1,1-dichloroethene (1,1-DCE) in groundwater from monitoring wells MW-02S, MW-03S, MW-09S, and MW-13S. Cis-1,2-DCE and vinyl chloride are daughter products of the anaerobic microbial reductive dechlorination of TCE (with ethene as the end product), and are not typically source materials. The presence of cis-1,2-DCE and vinyl chloride indicates that microbial reductive dechlorination of TCE is an important mechanism of natural attenuation at the site.

4.3.2 Deeper Zone Groundwater

The highest PCE concentration reported in the deeper zone groundwater monitoring wells occurred during the December 2013 sampling event at monitoring well MW-03D (5.4 µg/L). In December 2013, PCE was not detected above laboratory method detection limits in the remaining two deeper zone groundwater monitoring wells (MW-02D and MW-07D).

The highest historical TCE concentration reported in the deeper zone groundwater monitoring wells was 523 µg/L in the February 2011 groundwater sample collected from monitoring well MW-02D. In December 2013, TCE was reported above the MCL of 5 µg/L in the groundwater samples collected from deeper zone groundwater monitoring well MW-02D (347 µg/L).

The highest historical cis-1,2-DCE concentration reported in the deeper zone groundwater monitoring wells was 716 µg/L in the October 2011 groundwater sample collected from monitoring well MW-02D. In December 2013, cis-1,2-DCE was reported above the MCL of 70 µg/L in the groundwater samples collected from deeper zone groundwater monitoring wells MW-02D (653 µg/L) and MW-07D (114 µg/L).

The highest historical vinyl chloride concentration reported in the deeper zone groundwater monitoring wells was 53.6 µg/L in the February 2011 groundwater sample collected from monitoring well MW-02D.

Vinyl chloride was reported above the MCL of 2 µg/L in the December 2013 groundwater samples collected from shallow monitoring wells MW-02D (46.0 µg/L) and MW-07D (2.4 µg/L).

No other VOCs have been reported in the deeper zone groundwater monitoring wells at concentrations above the applicable MCLs.

4.4 Distribution of Contaminants in Groundwater

The groundwater analytical results discussed in Section 4.3 indicate that chlorinated VOCs (primarily TCE and its associated biodegradation products) are present at the site in surficial groundwater and within the shallow underlying weathered and fractured bedrock groundwater at concentrations above the MCLs. A source area was identified near the former lyophilizer area of Building D, where the highest concentrations of TCE, cis-1,2-DCE, and vinyl chloride were observed (Figures 9-11). A groundwater plume of chlorinated VOCs extends northward (downgradient) towards the monitoring well MW-02 cluster. The northernmost downgradient monitoring well cluster onsite (MW-07 cluster) also exhibited TCE, cis-1,2-DCE, vinyl chloride, and 1,1-DCE concentrations above MCLs in December 2013. The south to north distribution of select groundwater contaminants can be seen on cross section B – B' in Appendix B.

The width of the plume appears to be relatively narrow. Cross section C – C' in Appendix B incorporates groundwater grab sample analytical data from multiple locations between borings TW-4 and TW-10, which are respectively located immediately west and east of the former Building D footprint. The analytical results along this cross section indicate that a source area is present in the vicinity of monitoring well MW-13S and appears to be limited to the former lyophilizers area. The groundwater analytical data on cross sections A – A' and D – D' in Appendix B, which both traverse west to east through the monitoring well MW-02 cluster, indicates that the portion of the plume with the highest chlorinated VOC concentrations appears to be located between monitoring wells MW-012S on the west and monitoring well MW-011S on the east.

The highest concentrations of TCE, cis-1,2-DCE, and vinyl chloride, within the plume described above were observed in monitoring wells and groundwater grab samples screened in the shallow (uppermost) surficial saturated zone. As evident on cross section B – B' in Appendix B, chlorinated VOC concentrations in the apparent source area decreased as the sampling depth increased. At temporary boring TB-53, a groundwater grab sample was collected from the shallow surficial saturated zone (35 to 40 feet bgs) and just above the soil/bedrock interface (55 to 60 feet bgs). Although still present at concentrations above MCLs, the analytical results indicated that the TCE, cis-1,2-DCE, and vinyl chloride concentrations at the soil/bedrock interface were an order of magnitude less than those observed in the shallow surficial saturated zone. A similar observation can be made with monitoring wells screened at shallow and deeper intervals within the weathered and fractured bedrock. Although still present at concentrations above MCLs, TCE, cis-1,2-DCE, and vinyl chloride concentrations were generally an order of magnitude lower at both the MW-02 cluster and the MW-07 cluster.

The highest PCE concentrations were observed west of former Building D and appear to be localized in surficial groundwater the vicinity of the monitoring well MW-03S (Figure 8). Monitoring well MW-03D, which is screened in the weathered and fractured bedrock, exhibited a PCE concentration slightly above the MCL in December 2013. The groundwater analytical results also indicate there is potential contribution to the onsite chlorinated VOC contamination from an offsite source located potentiometrically upgradient of the site, as evident by the TCE and 1,1-DCE detections at monitoring wells MW-06S and MW-09S and PCE detections at monitoring wells MW-08S and MW-010S. The horizontal extent of the PCE, TCE, total 1,2-DCE, and vinyl chloride impacts are further illustrated on Figures 8, 9, 10, and 11, respectively.

Saturated zone contaminant mass calculations (dissolved phase and adsorbed phase) were performed using chlorinated VOC concentrations reported above MCLs in monitoring wells sampled during the December 2013 groundwater sampling event and from historical groundwater grab samples. Since its extent was the greatest, the 5 µg/L contour for TCE (Figure 9) was used as the basis for determining the impacted surface area in both the saturated overburden material and the saturated bedrock. Based on an approximate surface area of approximately 190,000 square feet in this area and an estimated saturated contaminant thickness of 25 feet, approximately 380 pounds of chlorinated VOCs were estimated to remain in the saturated overburden material at the site. Approximately 244 pounds of chlorinated VOCs were estimated to remain in the saturated bedrock. When compared to the vadose zone contaminant mass calculation discussed in Section 3.0 (a relatively small volume of approximately 12 pounds of chlorinated VOCs), the saturated zone mass calculations indicate that the majority (approximately 98%) of the contaminant mass present at the site is located in the saturated zone. Saturated zone contaminant mass calculations can be found in Appendix C.

4.5 Geochemical Conditions

The presence of cis-1,2-DCE and vinyl chloride indicates that microbial reductive dechlorination processes are occurring in both the shallow and deeper zone groundwater at the site. The geochemical analytical results and field parameter measurements collected during the September 2012 and December 2013 monitoring events further demonstrate that the aquifer conditions are anaerobic and favorable for the reductive dechlorination process. The specific indicator parameters include low dissolved oxygen (DO) levels, pH readings between 6 and 8 standard units, groundwater temperature above 20 degrees Celsius, and reduced nitrate and iron levels in suspected source areas. Negative oxidation-reduction potential (ORP) readings, which are typically indicative of a geochemically reducing environment, were observed in the deeper zone groundwater monitoring wells. ORP readings were generally less than 100 millivolts in the shallow zone groundwater. Methane concentrations above

500 µg/L were reported in suspected source area monitoring wells MW-02S and MW-13S, which is indicative of strongly reducing conditions and co-metabolic activity. Additionally, ethane and ethene, the ultimate breakdown products of the microbial reductive dechlorination of chlorinated VOCs, were both reported in groundwater samples collected in September 2012 and December 2013, indicating the complete breakdown of chlorinated compounds is occurring in groundwater at the site. The low total organic carbon (TOC) concentrations observed in the September 2012 and December 2013 groundwater samples, however, indicates that microbial reductive dechlorination processes are limited by suitable carbon substrates to serve as electron donors.

Current and historical groundwater geochemical analytical results and field parameter measurements are presented in Table 6. The 2013 geochemical and field parameter results are generally consistent with historical data, which indicates that favorable conditions exist and have existed at the site for reductive dechlorination.

5.0 REMEDIAL ALTERNATIVES EVALUATION

Establishing remedial action objectives is an important step toward evaluating remedial alternatives for the site. The overall objective of the site remedial action is to protect human health and the environment by reducing or eliminating the risk to potential receptors from the impacted soil and groundwater. For human exposures onsite, there is one potentially complete pathway: the inhalation of chlorinated hydrocarbons migrating through the subsurface and into indoor air. Exposures to groundwater via typical tap water pathways (ingestion, dermal contact, etc.) are not complete as the site is serviced by public water and there are no production wells used to supply groundwater for consumption at the site. In addition, Pfizer will place groundwater use restrictions in the Deed to prevent future onsite use for potable purposes.

Impacted groundwater has been detected at the most downgradient wells located on site. Based on the 2012 well survey conducted by Alpha Engineering Group on behalf of Pfizer, downgradient properties (within one-half a mile of the site) are not likely using groundwater for potable and/or other household uses (e.g., irrigation); however, there is a potential for future use. The use of impacted downgradient groundwater may result in risks above regulatory target risk ranges for both carcinogenic and non-carcinogenic effects based on the ingestion pathway. Therefore, the remedial objectives for this site include shrinking the groundwater plume to mitigate the potential offsite migration of chlorinated hydrocarbons.

5.1 Media and Constituents of Concern

The remedial alternatives evaluation was primarily focused on shallow source area groundwater present above the soil/bedrock interface and on shallow and deeper bedrock groundwater near the downgradient property boundary. Since a significant source within the vadose zone at the site has not been identified nor appears to exist, no soil remediation is deemed necessary for the site at this time; however, contingent soil remedies are discussed below and may be enacted if a significant source is encountered during implementation of the groundwater remedy. The COCs in the groundwater at the site include PCE, TCE, cis-1,2-DCE, vinyl chloride, and 1,1-DCE.

The effectiveness of a particular remedy will depend in large part on the chemical, physical, and toxicological properties of the COCs, which are all chlorinated constituents and have the capability of biodegrading under anaerobic conditions, being chemically oxidized at rapid rates, and being stripped from the liquid phase due to their relatively high volatility and low water solubility.

5.2 Screening Criteria

Potential remedial technologies were identified for the COCs and screened to determine viable remedial alternatives for a more detailed analysis. The screening process evaluated the alternatives based on the following criteria: long-term and short-term human health and environmental effects; implementability;

operation and maintenance requirements; reliability; feasibility; estimated time required to achieve cleanup; and cost effectiveness. Table 7 summarizes the screening results for the potential remedial alternatives.

Long-Term and Short-Term Human Health and Environmental Effects

This criterion addresses whether the alternative adequately protects human health and the environment on both a short-term and long-term basis, and how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, and/or institutional controls. Remedial alternatives were evaluated with respect to the degree to which an alternative reduces contaminant toxicity, mobility, mass, volume, or propensity to bioaccumulate through treatment, engineering controls, and/or institutional controls; provides and maintains overall protection of human health and the environment on both a short-term and long-term basis; controls the ability of the COCs to migrate; eliminates, reduces, or controls residual risks posed through each exposure pathway; complies with applicable regulations; minimizes harmful effects and short-term impacts; and achieves reliable protection within a reasonable timeframe.

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation, and the adequacy and reliability of controls, such as containment systems and institutional controls, which are necessary to manage treatment residuals and untreated waste. Evaluating residual risk takes into account the remaining constituents' mass, volume, toxicity, mobility, and propensity to bioaccumulate.

Reduction of toxicity, mobility, mass, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy. The alternative is evaluated based on its effectiveness in reducing the harmful effects of the primary COCs, reducing the ability of the COCs to migrate, and reducing the concentrations of the primary COCs.

Short-term effectiveness addresses the period of time needed to implement the remedy and the risks that may be posed to workers, the community, and the environment during the construction and operation of the remedy until the remedial objectives are achieved.

Implementability

Remedial alternatives were evaluated based on the technical and administrative feasibility and availability of the technologies, including ease of construction and operation, site access, necessity for permits, and coordination with other governmental entities. Alternatives were evaluated to determine if special equipment would be required, specialty subcontractors would be required to implement, or facilities would not be available within a reasonable time period.

Operations and Maintenance Requirements

Remedial alternatives were evaluated with respect to ease or difficulty of operations and maintenance.

Reliability

Remedial alternatives were evaluated with respect to effectiveness, dependability, consistency, past experience, short-term and long-term reliability, and proven performance. Alternatives were evaluated to determine if the alternative would result in a further release of COCs or increase the risk to human health and/or the environment.

Feasibility

Remedial alternatives were evaluated to determine if the alternative would be technically feasible and practical with respect to the site conditions.

Estimated Time Required to Achieve Cleanup

Although it is difficult to accurately predict the time required to meet the remedial objectives, the relative time required was considered in evaluating the various remedial alternatives.

Cost Effectiveness

Remedial alternatives were evaluated based on the estimated capital construction and long-term operations and maintenance or monitoring costs of the alternative.

5.3 Evaluation of Remedial Technologies

5.3.1 Soil Remediation (Vadose Zone)

Chlorinated hydrocarbons have been reported in unsaturated soils and soil vapor at the site; however, a significant source within the vadose zone has not been identified. The analytical results from the soil samples collected from September 2010 to December 2013 indicated that VOCs were detected at the site at concentrations above laboratory method detection limits; however, the concentrations were not above the RSLs. The analytical results were also below the associated carcinogenic screening levels for an inhalation exposure pathway.

Sub-slab, soil vapor samples from underneath former Buildings D and E and soil gas samples collected adjacent to site buildings indicated VOC concentrations above OSWER Generic Screening Levels for Shallow Soil Gas and Deep Soil Gas, respectively. However, indoor air samples did not indicate concentrations of COCs above applicable risk levels. The contingent soil remedies discussed below may be enacted if a significant source is encountered during implementation of the groundwater remedy.

Soil Excavation

Source removal includes physical removal of impacted soil using one of many techniques that may include hand excavation, mechanical excavation, and excavation using large-diameter augers. Physical source removal is often the most efficient means of mass removal, and is considered highly reliable. Frequently, following source removal, significant reductions of groundwater contaminant concentrations are observed, and very rarely will concentrations rebound considerably. Excavation is generally more applicable to localized, shallow impacted soils. Where feasible to implement, source removal is the preferred soil remediation technology.

Soil Vapor Extraction

Soil Vapor Extraction (SVE) involves installation of horizontal and/or vertical vapor extraction wells that are connected to a vapor extraction system. The system typically includes a high-vacuum blower or liquid ring vacuum pump with a vapor/liquid separator, and discharge system. The vapor extraction system pulls soil vapor through impacted soil to strip contaminants, which are then treated and/or discharged. The extraction rate is typically high enough to remove multiple pore volumes of vapor on a daily basis, which provides a favorable mass removal rate. At higher concentrations, liquid and/or soil vapor treatment systems may be added to reduce emissions as necessary to meet regulatory obligations. Where excavation is impractical, SVE is one of the few viable alternatives for soil remediation which can address a larger area or deeper impacted soils. SVE is often effective in environments similar to those at the site.

In-Situ Chemical Oxidation

In-Situ Chemical Oxidation (ISCO) involves the injection of a strong oxidant into the soil matrix to oxidize or destroy COCs in place, converting the compounds into harmless byproducts, such as carbon dioxide and water. A chemical oxidation reaction breaks chemical bonds, removes electrons from the contaminant, and transfers the electrons from the contaminant to the oxidant. The contaminant is in turn oxidized and the oxidant (electron acceptor) is reduced. The oxidant must come into contact with the contaminant to be effective; therefore, an effective delivery mechanism is critical to the success of ISCO as a remedial alternative.

The most commonly used oxidants are ozone, peroxides, permanganates (sodium and potassium), and persulfates. In some cases, other chemicals are injected in concert with the oxidants that function as a catalyst for a desired reaction. For instance, Fenton's Reagent is a specialized application where iron is injected as a catalyst with hydrogen peroxide.

The criteria for determining the effectiveness and applicability of a chemical oxidant for a particular site include the following:

- Safety;
- Reactivity (Thermodynamics);
- Speed of Reaction (Kinetics);

- Longevity; and
- Cost.

Three principal factors are critical in designing an effective ISCO remediation project:

- Oxidant Selection;
- Oxidant Loading; and
- Oxidant Delivery.

Bench-scale treatability testing is useful in selecting the appropriate oxidant and loading rates; whereas, field studies are useful in determining the optimum oxidant delivery mechanism means and methods.

5.3.2 Groundwater Remediation

Chlorinated hydrocarbons are present at the site in overburden and bedrock groundwater at concentrations above the EPA MCLs. The remedial objectives for this site include enhancing and accelerating the natural degradation processes that are actively occurring at the site to stabilize and shrink the groundwater plume and mitigate the potential offsite migration of chlorinated hydrocarbons. The groundwater remedial alternatives discussed below were screened per the remedial objectives.

Monitored Natural Attenuation

Natural attenuation with monitoring involves allowing natural subsurface processes, such as dilution, dispersion, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials to reduce chemical constituent concentrations to acceptable levels. Consideration of this option usually requires an evaluation of contaminant degradation rates and pathways, and predicting contaminant concentrations at downgradient receptor points. The primary objective is to demonstrate that natural processes of contaminant degradation will reduce constituent concentrations to meet remedial objectives before potential exposure pathways are completed. Long-term monitoring must be conducted throughout the process to confirm that degradation is proceeding at rates consistent with meeting the cleanup objectives.

This remedial alternative may also be used in conjunction with one of the remaining technologies as a long-term remedial solution once source area concentrations are depleted. The current geochemical conditions and the presence of cis-1,2-DCE, vinyl chloride, ethane, and ethene suggests that microbial reductive dechlorination is an important mechanism of natural attenuation of chlorinated VOCs in both the shallow and deeper zone groundwater at the site.

Enhanced Bioremediation with Monitored Natural Attenuation

Chlorinated constituents, such as those identified at the site, typically are biodegraded under natural conditions via reductive dechlorination, which is a process that requires both electron acceptors (the chlorinated aliphatic hydrocarbons) and an adequate supply of electron donors.

Enhanced bioremediation involves amending the groundwater with carbon substrates (biostimulation) to serve as electron donors to support the microbial reductive dechlorination of the COCs and/or adding microorganisms adapted for degradation of the specific contaminants to the aquifer (bioaugmentation) to augment the existing microbial population.

Biostimulant amendments can be injected into the aquifer to enhance the biological degradation of the residual chlorinated constituents that is naturally occurring on-site. These amendments are metabolized by subsurface microbes to generate hydrogen, which is used to support the anaerobic reductive dechlorination of chlorinated ethenes. This technology could also be used in conjunction with zero-valent iron and/or monitored natural attenuation.

Air Sparging with Monitored Natural Attenuation

Air sparging is an in-situ technology in which air is injected through an impacted aquifer. The injected air traverses horizontally and vertically in channels through the soil column, creating an underground stripper that removes chemical constituents by volatilization. This injected air helps to flush (bubble) the contaminants up into the unsaturated zone where an SVE system is typically used in conjunction with air sparging to remove the vapors. This technology is designed to operate at high flow rates to maintain increased air contact with the groundwater and soil to strip volatile constituents from the groundwater.

This remedial alternative was eliminated from further consideration for the following reasons:

- Air flow through the saturated zone may not be uniform and there can be uncontrolled movement of potentially harmful vapors.
- Soil heterogeneity may cause different zones to be affected to varying degrees and some zones to be relatively unaffected.
- Due to mounding effects, groundwater contaminants may migrate to previously unimpacted areas.
- Low permeability zones (bedrock) would limit the effectiveness of air sparging.
- The capital and long-term operations and maintenance costs would be high relative to other options.

Thermal Treatment with Monitored Natural Attenuation

Thermal remediation can efficiently assist in removing VOC mass from low-permeability lenses and units. Thermal remediation includes increasing the ambient temperature of the environment, which results in increased volatility and enhanced recovery of contaminants. In addition, heating increases natural biodegradation processes and can increase abiotic degradation rates for certain compounds. Coupled with SVE, thermal treatment will result in significantly increased mass removal rates, and can substantially reduce the time required for remediation. A common concern for thermal remediation is the potential for vapor migration into structures. In addition, geotechnical considerations associated with the possible desiccation of cohesive soils and associated ground settlement should be evaluated.

Thermal treatment may be a viable remedial alternative to treat chlorinated VOCs present in the overburden material at the site; however, the capital and long-term operations and maintenance costs would be high relative to other options. In addition, thermal treatment may prove to be an ineffective treatment mechanism for chlorinated VOCs present in the weathered and fractured bedrock.

Zero-Valent Iron Treatment with Monitored Natural Attenuation

Zero-valent iron (ZVI) has been demonstrated to be an effective amendment for the treatment of chlorinated VOCs in groundwater. As the iron is oxidized, a chlorine atom is removed from the compound by one or more reductive dechlorination mechanisms, using electrons supplied by the oxidation of iron. As ZVI is oxidized to ferrous and/or ferric iron, the pH increases, hydrogen is generated, oxidizable materials are consumed, and the strong reducing conditions created are favorable for microbial reductive dechlorination pathways. Mineral precipitates of carbonates, sulfides, and/or oxides may form coatings on the reactive grains, inhibit the performance of the iron, and reduce the porosity and permeability of the aquifer, but complete destruction of chlorinated hydrocarbons can still be achieved. Additionally, the generation of strong reducing conditions and hydrogen gas can foster anaerobic microbial growth and increase natural biological degradation (Henn and Waddill 2006). The iron granules are dissolved by the process, but the metal disappears so slowly that the treatment zone may remain effective for many years.

Although treatment of the entire plume using ZVI would be costly, localized injections focused on areas with the highest chlorinated hydrocarbon concentrations could be a cost effective approach for treating areas with the highest mass of chlorinated hydrocarbons. This technology could also be used in conjunction with enhanced bioremediation and/or monitored natural attenuation, if enhanced bioremediation alone does not achieve the remedial objectives in a suitable timeframe.

Permeable Reactive Barrier

This remedial alternative involves installing a permeable reaction wall across the flow path of the contaminant plume, allowing the water portion of the plume to passively move through the wall. These barriers allow the passage of water while prohibiting the movement of contaminants by using such agents as ZVI, sorbents, and other media. Modifications to the basic passive treatment walls may involve installing a cutoff wall of low hydraulic conductivity that directs the impacted groundwater to the high conductivity reactive/treatment wall. Cutoff walls are typically slurry walls or sheet piles.

This remedial alternative was eliminated from further consideration for the following reasons:

- The capital costs would be high relative to other options, especially considering the depth and media associated with the groundwater impacts.
- The reactive or sorbent media would have to be replaced periodically due to the large extent of the plume and slow release of contaminants from impacted low permeability saturated soils, which would result in costly media replacement.

- The implementation would be difficult due to installation in bedrock and observed low groundwater flow velocities in this zone.

5.4 Selected Remedial Alternative

Based on the remedial alternatives evaluation, the selected remedial approach is implementation of an in-situ treatment system to remove (treat) chlorinated hydrocarbons through enhanced bioremediation in shallow source area groundwater, within the core of the plume, and along the downgradient property boundary. This alternative was selected over monitored natural attenuation only since the current natural biodegradation rates at the site are not likely to meet the remedial objectives for the site in a suitable timeframe. A pre-Remedial Design (RD) field test will be performed prior to full-scale implementation of this RAP to evaluate the effectiveness of the treatment, determine the preferred amendment delivery mechanism, and refine site-specific design parameters (e.g. injection/treatment spacings). The site remedy will also include restrictions (Institutional Controls) to prevent future onsite use of groundwater for potable purposes and building construction engineering controls as necessary to mitigate potential soil vapor migration.

6.0 ENHANCED BIOREMEDIATION FIELD TEST

Prior to full-scale implementation, an enhanced bioremediation pre-RD field test will be performed to evaluate the effectiveness of the treatment, determine the preferred amendment delivery mechanism, and refine site-specific remedial design parameters. Based on the distribution of contaminants discussed in Section 4.3 and the remedial objectives for the site, the field test will be implemented in the following three areas: the area along the northern property boundary in the vicinity of downgradient monitoring wells MW-07S and MW-07D (Field Test Area A), the downgradient source area in the vicinity of monitoring well MW-02S and temporary boring TB-46 (Field Test Area B), and the source zone near the former lyophilizer area of Building D (Field Test Area C). The three field test area locations are presented on Figure 12. Field Test Area A, Field Test Area B, and Field Test area C are presented in detail on Figures 12A, 12B, and 12C, respectively.

6.1 Injection Locations and Installation

6.1.1 Field Test Area A

Field Test Area A will be used to evaluate the effectiveness of enhanced bioremediation on impacted groundwater present in shallow and deeper zone bedrock near the northern property boundary. Since a water-bearing zone was not observed in the overburden material during monitoring well installation activities in this area, monitoring wells MW-07S and MW-07D were both screened in the volcanic rock underlying the overburden material. Monitoring well MW-07S was screened within the first water-bearing zone encountered (approximately 30 to 40 bgs), and monitoring well MW-07D was screened within the second water bearing zone encountered (approximately 90 to 100 feet bgs). In December 2013, monitoring well MW-07D exhibited cis-1,2-DCE and vinyl chloride concentrations slightly above the applicable MCLs; however, TCE, the parent compound of those constituents, was not detected at a concentration above its MCL. As such, the field test in this area will be focused primarily on the shallow zone bedrock groundwater, which exhibited higher chlorinated VOC concentrations, including TCE.

The Field Test Area A injection well network will consist of three injection wells (INJ-1, INJ-2, and INJ-3) that will be installed approximately 15 feet upgradient of the monitoring well MW-07 cluster at the locations indicated on Figure 12A. The wells will be advanced using hollow-stem augers, air-rotary techniques, or other appropriate drilling methods and will be cased from the ground surface to the top of the soil/bedrock interface using six-inch diameter Schedule 40 polyvinyl chloride (PVC) and set with bentonite/grout mixture. During the installation of the monitoring well MW-07 cluster, the soil/bedrock interface was observed to be approximately 15 feet bgs Once the bentonite/grout mixture has set, drilling activities will resume and penetrate the volcanic rock to a total depth of 40 feet bgs, leaving an open borehole in the rock from approximately 15 to 40 feet bgs. The wells will be completed at the ground surface (flush-mount) with two-foot by two-foot concrete pads, 12-inch diameter steel manholes, and locking caps. The horizontal spacing between the injection wells will be approximately 15 feet. The

Field Test Area A injection well construction diagrams are presented on Figure 13. A cross sectional view of the Field Test Area A is presented on Figure 14.

6.1.2 Field Test Area B

Field Test Area B will be used to evaluate the effectiveness of enhanced bioremediation on impacted groundwater present in overburden soils downgradient of the source area using semi-permanent injection wells. Chlorinated VOC concentrations observed in shallow groundwater present in the vicinity of the monitoring well MW-02 cluster and temporary boring TB-46. Since monitoring well MW-02S is screened within the volcanic rock, the effectiveness of amendment distribution through overburden injection in the rock may not be observed in the field test timeframe. Therefore, a new overburden monitoring well (MW-16S) will be installed at the former location of temporary boring TB-46 to monitor the effectiveness of the treatment. During the advancement of temporary boring TB-46, a saturated thickness of approximately 6 to 8 feet was observed in the overburden material atop the volcanic rock, which was encountered at a depth of approximately 44 feet bgs.

The Field Test Area B well network will consist of new monitoring well MW-16S and three injection wells (INJ-4, INJ-5, and INJ-6) that will be installed approximately 15 feet upgradient of monitoring well MW-16S, as indicated on Figure 12B. The wells will be advanced using hollow-stem augers, air-rotary techniques, or other appropriate drilling techniques to the top of the soil/bedrock interface and will be constructed of 10 feet of two-inch diameter Schedule PVC well screen (0.010-inch slot size) set atop the interface and an appropriate length of two-inch diameter Schedule 40 PVC riser pipe to the ground surface. The total depths of the wells will be field determined based on the depth to bedrock encountered during drilling activities. The wells will be completed at the ground surface with two-foot by two-foot concrete pads, 8-inch diameter steel manholes, and locking caps. The horizontal spacing between the injection wells will be approximately 15 feet. The Field Test Area B injection well and monitoring well MW-16S construction diagrams are presented on Figure 13. A cross sectional view of the Field Test Area B is presented on Figure 14.

6.1.3 Field Test Area C

Field Test Area C will be used to evaluate the effectiveness of enhanced bioremediation on impacted groundwater present in overburden soils in the potential source zone near the former lyophilizer area of Building D using direct push technology (DPT). Chlorinated VOC concentrations observed in shallow groundwater samples collected from this area, including samples from monitoring well MW-13S and temporary borings TB-48, TB-53, and TB-56, were the highest observed at the site.

The Field Test C injection network will consist of eight DPT injection points (DPT-1 through DPT-8) advanced to the top of the soil/bedrock interface at the locations indicated on Figure 12C. Once the DPT points are in place, the injections will take place from the top of the soil/bedrock interface to the top of the saturated zone (bottom-to-top method). During the advancement of temporary boring TB-53, a saturated thickness of approximately 25 feet was observed in the overburden material atop the volcanic rock, which was encountered at a depth of approximately 60 feet bgs.

To aid in performance monitoring in this area, two new monitoring wells (MW-17S and MW-18S) will be installed using hollow-stem augers, air-rotary techniques, or other appropriate drilling techniques at the former location of temporary boring TB-56, which will be approximately 15 feet downgradient of injection points DPT-1 through DPT-4. Monitoring well MW-18S will be advanced to the top of the soil/bedrock interface and will be constructed of 10 feet of two-inch diameter Schedule PVC well screen (0.010-inch slot size) set atop the interface and an appropriate length of two-inch diameter Schedule 40 PVC riser pipe to the ground surface. The total depth of the well will be field determined based on the depth to bedrock encountered during drilling activities. Monitoring well MW-17S will be advanced to a total depth of 40 feet bgs and will be constructed of 10 feet of two-inch diameter Schedule PVC well screen (0.010-inch slot size) and an appropriate length of two-inch diameter Schedule 40 PVC riser pipe to the ground surface. The wells will be completed at the ground surface with two-foot by two-foot concrete pads, 8-inch diameter steel manholes, and locking caps. Existing monitoring well MW-13S will also be used to monitor the effectiveness of the treatment in this area.

If DPT is determined to be an ineffective method of drilling/treatment in this area, injections wells will be installed at the DPT injection point locations and screened appropriately to cover the estimated treatment thickness. The monitoring well construction diagrams for monitoring wells MW-17S and MW-18S are presented on Figure 13. A cross sectional view of the Field Test Area C is presented on Figure 14.

6.2 Design of Electron Donor Amendment

The mass of electron donors to be injected is initially based on the stoichiometric requirement for complete conversion of PCE, TCE, cis-1,2-DCE, and vinyl chloride to ethene, based on recent groundwater conditions in each of the three field test areas. Groundwater monitoring data (including TOC concentrations) collected from injection wells and monitoring wells following the first injection event will be used to refine the mass of sodium lactate injected in subsequent amendment injections. The stoichiometric requirement is calculated by determining the electron equivalents generated from the catabolic oxidation of sodium lactate in comparison to the electron equivalents required for complete reduction of VOCs and other competing electron acceptors (such as nitrate, manganese, iron, and sulfate). In addition, contingency factors are included in the calculation to account for potential inefficiencies in the process, such as consumption of sodium lactate by methanogenic bacteria. The first injection event in Field Test Area A and Field Test Area C will consist of approximately 12 kg of sodium lactate (approximately 15 liters of 60% sodium lactate solution) per injection point; however, the mass of sodium lactate may be increased to a maximum of 50 kg per injection point in subsequent injections, if necessary, based on performance monitoring data. The first injection event in Field Test Area B will consist of approximately 6 kg of sodium lactate (approximately 8 liters of 60% sodium lactate solution) per injection point; however, subsequent injection events may consist of a maximum of 15 kg (~ 19 liters) per injection point, if necessary, based on performance monitoring data. Stoichiometric design calculations for each of the three field test areas are presented in Appendix E. Amendment information and a material safety data sheet is included in Appendix F.

6.3 Injection Procedures

The field test will consist of up to six injection events over a six month period. The actual number of injection events will be based on the results of the monthly performance monitoring, as described in Section 6.4. In each of the three field test areas, truck-mounted, 500-gallon polyethylene tanks will be used to mix the sodium lactate solution with anoxic groundwater and distribute the solution into the formation. The anoxic groundwater will be pumped from an onsite monitoring well with VOC concentrations below the applicable MCLs and low (less than one mg/L) dissolved oxygen concentrations. Based on the VOC and dissolved oxygen concentrations observed during the December 2013 groundwater sampling event, monitoring wells MW-01S, MW-04S, MW-05S, MW-14S, and MW-15S may be used to supply the anoxic groundwater. The subsequent injection procedures for each area are described below.

In Field Test Area A, each of the three injection wells (INJ-1, INJ-2, and INJ-3) will receive up to 1,000 gallons of anoxic groundwater mixed with 12 kg of sodium lactate (approximately 15 liters of 60% sodium lactate solution) during the first injection event. In Field Test Area B, each of the three injection wells (INJ-4S, INJ-5S, and INJ-6S) will receive up to 1,000 gallons of anoxic groundwater mixed with approximately 6 kg of sodium lactate (approximately 8 liters of 60% sodium lactate solution) during the first injection event. The mixing tank effluent will be controlled by a ball valve connected to an injection hose equipped with an in-line stainless steel manifold to allow simultaneous injection into multiple injection wells. If mixing results in the injection fluids becoming too rich in oxygen (thus limiting the effectiveness of the remedial amendment), then a suitable additive will be used to maintain the anoxic conditions of the injection fluids. Each leg of the manifold will be equipped with a flow meter, valve, and pressure gauge. The end of the injection hoses will be equipped with male couplings for a cam and groove hose coupling assembly. The injection hose will connect to a female end of the cam and groove hose coupling assembly attached the wellhead. Once the injection assembly has been attached, the mixed amendment will be injected using a transfer pump at a maximum pressure of 5 pounds per square inch (psi). If high back-pressures are observed on the manifold pressure gauges, the volume of anoxic groundwater used for mixing will be reduced. Following the amendment injection, up to 100 gallons of anoxic groundwater water will be flushed through each of the injections wells to enhance transport of the amendment solution away from the well. The injection flow rates and actual injection volumes will depend on the ability of the formation to receive the water.

In Field Test Area C, each of the eight injection points (DPT-1 through DPT-8) will receive up to 250 gallons of anoxic groundwater mixed with 12 kg of sodium lactate (approximately 15 liters of 60% sodium lactate solution) during the first injection event using a pressurized injection system and DPT. The eight injection points will be advanced to the top of the soil/bedrock interface (estimated 60 feet bgs) to deliver the amendment into the subsurface. Once the injection points are in place, the amendment will be injected from the top of the soil/bedrock interface to the top of the saturated zone in a bottom-to-top method. The mixed amendment will be injected using DPT at a maximum pressure of 5 psi. The injection flow rates and actual injection volumes will depend on the ability of the formation to receive the water. If day-lighting or high back-pressures are observed, the volume of anoxic groundwater used for mixing will be reduced. The injection header system will include a flow meter and a standard back-pressure gauge. The boreholes at each of the injection locations will be backfilled with Portland Cement grout upon completion.

The field test injection program is detailed in Table 8. Injection equipment literature is provided in Appendix G.

6.4 Performance Monitoring and Evaluation

Prior to the initiation of the field test study, a groundwater sampling event will be conducted in order to establish baseline concentrations at newly installed monitoring wells MW-16S, MW-17S, and MW-18S. Monthly groundwater monitoring will then be conducted over the six-month injection period to evaluate the effectiveness of the treatment and refine the amendment dose over time at each of the three field test areas. The performance monitoring program will include analysis of VOCs, TOC, biogenic gases, and select natural attenuation parameters, as summarized in Table 9.

Groundwater samples will be collected in accordance with the EPA protocols for low-flow purging and sampling. New and disposable polyethylene tubing will be inserted into the water column of each monitoring well, and pumping will be accomplished using a peristaltic pump and disposable silicon tubing. Prior to sampling the monitoring wells, each well will be purged until the field parameters stabilize to less than 10 percent fluctuation (if practical) to assure representative formational groundwater will be sampled. Purge volumes and field parameters will be measured and recorded on groundwater sampling data sheets.

Each sample will be labeled with a unique identification number attached to the outside of the sample container, and the samples will be placed into a laboratory-provided cooler and preserved on ice at a maximum temperature of four degrees Celsius. The samples will be relinquished with the appropriate chain-of-custody documentation to Pace Analytical Services, Inc. and analyzed in accordance with the parameters and analytical methods provided in Table 9. During each sampling event, one equipment blank and one field duplicate sample and one trip blank will be collected for quality control purposes.

6.5 Utility Clearance and Site Preparation

Golder will obtain applicable permits prior to implementing the proposed scope of work. Well installation permits will be required for the monitoring well and injection well installations. Given that the work will be conducted on private property, a public provider might not be able to provide details regarding specific utilities in the area where well construction will be conducted. Available facility design or as-built drawings that can be provided by Pfizer will be reviewed to assist with locating underground utilities or other infrastructure. Access and logistical considerations will be coordinated with Pfizer.

6.6 Investigation Derived Waste

Investigation derived waste (IDW) generated during well installation activities will be contained in 55-gallon steel drums and disposed in accordance with applicable regulations. Composite samples will be collected for both the soil cutting IDW and purge/development water IDW. Soil IDW samples will be subjected to the Toxicity Characterization Leaching Procedure (TCLP) and analyzed by EPA Method 6010, EPA Method 7470, EPA Method 8270, and EPA Method 8260. The purge/development water IDW sample will be subjected to TCLP and analyzed by EPA Method 8260.

6.7 Underground Injection Control Permit

Implementation of this field test may require an Underground Injection Control (UIC) permit application for Class V injection wells to be filed with the Puerto Rico Department of Environmental Quality (PR-EQB); however, approval of a Remedial Action Plan by PR-EQB may also serve as sufficient approval for remediation injection wells – in lieu of a UIC permit. The injection wells will be considered in-situ groundwater remediation wells.

6.8 Health and Safety

Site work will be completed in accordance with Golder's safety policies and procedures and applicable regulations. The specific health and safety procedures will be addressed in a separate site-specific Health and Safety Plan (HASP) for the type of work to be completed during remedial activities. The HASP will include Material Safety Data Sheets, maps and directions to the nearest hospital, project personnel and emergency contact information, general safety procedures, and control measures for the potential physical, chemical, and biological hazards at the site. Personnel working in potentially impacted areas will have completed 40 hours of Hazardous Site Health and Safety Training as required by OSHA 29 CFR 1919.120 (f) regulations. Site workers will attend daily job safety briefings at the beginning of each field day to discuss upcoming site activities. Additional job safety briefings will be completed as required by changes in site conditions and/or activities.

7.0 REMEDIAL SCHEDULE

Upon securing the necessary well installation permit, the installation of the remedial network, including new monitoring well and injection well installations, should be accomplished over a period of approximately three to five weeks. Golder anticipates that it will take approximately 60 days to obtain the UIC permit from the date of application submission. Therefore, implementation of the pre-RD field test injection program will be initiated within one month of obtaining the UIC permit, if necessary, and will continue for six months.

Upon completion of the pre-RD field test injection program, a RAP addendum will be developed to document the field test and the results of the monthly performance monitoring events. If the treatment is determined to be effective, full-scale site-specific design parameters, including injection well or injection point spacing, injection frequency, and amendment composition, will be refined and included in the report.

GOLDER ASSOCIATES INC.

Matthew C. Crews
Project Engineer

Robert Illes
Principal

Karem H. Esin, PE
Senior Consultant and Associate

MCC/ams

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TABLES

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-16	6/12/2013	0-1	--	None		Concrete Slab
		1-2	141.0	None	TB-16	Brown medium sand, trace clay
		2-3	0.7	None		Grey clay
		3-4	0.4	None		Grey- brown clay
		4-5	0.3	None		
		5-6	0.5	None		
		6-7	0.7	None		Brown-red sandy clay
		7-8	0.7	None		Grey - brown clay
		8-9	1.2	None		
		9-10	0.7	None		
		10-11	8.0	None		Grey brown sand, trace clay
		11-12	1.3	None		Red- brown sand, trace clay
		12-13	82.8	None		
TB-17	6/12/2013	0-1	--	None		Concrete Slab
		1-2	0.5	None		Dark grey gravel and coarse sand
		2-3	--	--		No recovery in sampler. Refusal conditions at 7.5 feet.
		3-4	--	--		
		4-5	--	--		
		5-6	--	--		
		6-7	--	--		
		7-8	--	--		

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-18	6/13/2013	0-1	--	--		Concrete Slab
		1-2	240.3	Slight		Medium to coarse brown and black sand
		2-3	277.2	Strong	TB-18	Brown and black clayey sand
		3-4	--	Strong		Red and brown clayey sand
		4-5	30.7	Strong		
		5-6	24.4	Strong		Brown and grey clayey sand
		6-7	16.5	Strong		
		7-8	--	--		Grey and black gravel, saturated
		8-9	--	--		
		10	--	--	TB-18 GW	
TB-19	6/13/20113	0-1	--	--		Concrete Slab
		1-2	7.3	Slight		Medium to coarse brown and black sand
		2-3	6.8	Slight		
		3-4	11.0	None		Medium to coarse brown and black sand, trace clay
TB-20	6/13/2013	0-1	--	--		Concrete Slab
		1-3	3.3	None		Medium to coarse brown and black sand, trace clay
		3-4	3.0	None		
		4-5	6.0	None		
		5-6	4.5	None		Brown-grey clayey sand, some gravel
		6-7	2.0	None		Brown-grey clayey sand, some gravel, saturated

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-21	6/13/2013	0-1	--	--		Concrete Slab
		1-2	0.8	None		Coarse brown-grey sand
		2-3	2.3	None		
		3-5	2.9	None		Coarse brown-grey sand with volcanic gravel
		5-6	0.9	None		
		6-7	0.7	None		Red clayey sand
		7-8	0.7	None		Fine red sand trace clay
		8-9	4.2	None		Grey clay and fine red sand
		9-10	0.9	None		Fine red - grey sand
		10-11	0.7	None		
		11-12	2.4	None		
		13-14	0.5	None		
TB-22	6/13/2013	0-1	--	--		Concrete Slab
		1-2	0.3	None		Coarse brown- grey sand
		2-3	0.4	None		Coarse brown- grey sand, trace clay, some gravel
		3-4	0.4	None		Fine brown- grey sand, trace clay
		4-5	1.0	Strong	TB-22	
		5-6	0.2	Slight		
		6-7	0.1	Slight		

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-23	6/14/2013	0-0.5	--	--		Concrete Slab
		0.5-2.5	0.0	None		Brown grey clay, some sand
		2.5-4.5	0.1	None		Fine brown-red sand, trace clay
		4.5-6.5	0.0	None		
		6.5-8.5	0.0	None		
		8.5-10.5	0.0	None		
		10.5-12.5	0.0	None		
		12.5-13.5	0.0	None		
		13.5-14.5	0.0	None		
TB-24	6/14/2013	0-0.5	--	--		Concrete Slab
		0.5-1.5	0.2	None		Medium grey sand, trace clay, some gravel
		1.5-2.5	0.1	None		
		2.5-3.5	0.4	None		Medium to coarse grey-brown sand
		3.5-4.5	0.3	None		
		4.5-5.5	0.7	None		
		5.5-6.5	0.5	None		
TB-25	7/15/2013	1	1.1	--		Bottom of slab, top of soil headspace
		1-3	0.3	None		Brown coarse sand and gravel
		3-5	--	None		No recovery in sampler
TB-26	7/15/2013	0.5	0.9	--		Bottom of slab, top of soil headspace
		2-4	0.4	None		Red and grey medium sand, trace clay
		4-6	0.0	None		Black and brown clay, some medium sand
		6-8	0.0	None		Black clay
		8-10	0.0	None		Black clay, some gravel

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-27	7/15/2013	0-2	--	--		Concrete Slab
		2-4	0.0	None		Red and brown medium sand, saturated
		4-6	0.0	None		
		6-8	0.2	None		
		8-10	0.2	None		
		10-12	0.1	None		
		12-14	0.3	None		
		14-16	0.2	None		
TB-28	7/15/2013	0.5	0.2	--		Bottom of slab, top of soil headspace
		1-3	0.0	None		Red and brown medium sand, trace clay
		3-5	0.0	None		Red and brown medium sand
		5-7	0.0	None		
		7-9	0.0	None		
		9-11	0.1	None		
		11-13	0.1	None		
		13-15	0.1	None		
TB-29	7/16/2013	0.5	0.5	--		Bottom of slab, top of soil headspace
		0.5-2.5	0.0	None		Brown clayey sand, moist
		2.5-4.5	0.1	None		Brown clayey sand, saturated
		4.5-6.5	0.0	None		Brown clay
		6.5-8.5	--	--		No recovery
		8.5-10.5	--	--		
		10.5-12.5	0.1	None		Red and grey clay
		12.5-14.5	0.1	None		Red and grey clay, trace sand
		14.5-16.5	0.0	None		Red and grey sand, saturated

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-30	7/16/2013	0-2	1.1	None		red and brown medium sand, saturated
		2-4	0.6	None		
		4-6	0.6	None		red and brown medium sand, moist
		6-8	0.5	None		red and brown medium sand, dry
		8-10	0.2	None		
		10-12	0.3	None		
		12-14	0.4	None		
		14-16	0.7	None		
TB-31	7/16/2013	0.5	0.0	None		Bottom of slab, top of soil headspace
		0.5-2.5	0.0	None		Clayey moist red and brown medium sand
		2.5-4.5	0.0	None		Red and brown sand, dry
		4.5-6.5	0.1	None		Clayey red and brown medium sand
		6.5-8.5	0.0	None		Red and brown medium sand, dry
		8.5-10.5	0.1	None		
		10.5-12.5	0.0	None		
		12.5-14.5	0.0	None		
TB-32	7/16/2013	0.5	0.0	--		Bottom of slab, top of soil headspace
		0.5-2.5	0.0	None		Red and brown medium sand
		2.5-4.5	0.1	None		Red and brown medium sand
		4.5-6.5	0.0	None		Red medium sand
		6.5-8.5	0.0	None		
		8.5-10.5	0.0	None		
		10.5-12.5	0.0	None		
		12.5-14.5	0.0	None		

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-33	7/16/2013	1	0.0	--		Bottom of slab, top of soil headspace
		1-3	0.0	None		Medium red sand, grey clay, some gravel
		3-5	104.4	Slight	TB-33	Grey clayey sand, saturated
		5-7	79.2	Slight		Grey clayey sand, saturated
		7-9	22.4	Slight		Grey clayey sand
		9-11	1.3	None		Brown fine sand
		11-13	0.2	None		
		13-15	0.3	None		
TB-34	7/17/2013	1	0.3	--		Bottom of slab, top of soil headspace
		1-3	0.3	None		red and brown coarse sand, moist
		3-5	0.4	None		
		5-7	0.3	None		
		7-9	0.2	None		
		9-11	0.2	None		
		11-13	0.2	None		red and brown coarse sand, saturated
		13-15	0.0	None		
TB-35	7/17/2013	0-2	0.2	None		Asphalt subgrade 8". Coarse red/brown clayey sand
		2-4	0.1	None		Coarse brown sand
		4-6	0.0	None		Coarse red and brown clayey sand
		6-8	0.0	None		Red and brown clay
		8-10	0.0	None		
		10-12	0.0	None		
		12-14	0.0	None		Red clayey sand overlain by green-grey clayey sand
		14-16	0.0	None		

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-36	7/17/2013	0-2	0.0	None		Asphalt subgrade red coarse sand
		2-4	0.0	None		Red and brown coarse sand, trace clay
		4-6	0.0	None		Red clay
		6-8	0.0	None		Red and brown clay
		8-10	0.0	None		
		10-12	0.0	None		
		12-14	0.0	None		Red and brown clayey sand
		14-16	0.0	None		
TB-37	7/17/2013	1	0.0	0.0		Bottom of asphalt top of soil
		1-3	1.1	1.1		Red and brown coarse sand. Bottom 6" gravel
		3-5	0.9	0.9		Red and brown coarse sand
		5-7	0.7	0.7		
		7-9	0.8	0.8		Red and brown coarse clayey sand
		9-11	0.4	0.4		
		11-13	0.3	0.3		
		13-15	0.3	0.3		
TB-38	7/17/2013	1-3	0.3	None		Grey clay, some coarse red sand
		3-5	0.2	None		
		5-7	0.1	None		Grey clay, moist
		7-9	0.4	None		Coarse red sand trace clay
		9-11	0.2	None		Coarse red sand
		11-13	0.3	None		
		13-15	0.2	None		

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TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-39	7/17/2013	0-1	0.0	--		Bottom of slab, top of soil
		1-3	0.0	None		Red and grey clayey sand
		3-5	0.0	None		Red coarse sand, dry
		5-7	0.0	None		
		7-9	0.9	None		
		9-11	0.4	None		Red coarse sand, moist
		11-13	0.7	None		
		13-15	0.3	None		
TB-40	7/17/2013	0-2	1.3	None		Red and brown coarse sand, trace clay
		2-4	0.7	None		
		4-6	0.5	None		
		6-8	0.5	None		
		8-10	0.0	None		Coarse red sand, moist
		10-12	0.1	None		
		12-14	0.2	None		
		14-16	0.2	None		
TB-41	7/18/2013	20-22	83.2	Strong	TB-41	Coarse grey sand and gravel, moist
		25-27	51.4	Strong		Gravel and coarse sand, saturated
		30-32	33.7	Strong		
		35-37	2.1	None	TB-41-GW	Coarse red sand
		40-42	1.2	None		Water table

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TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-42	7/19/2013	0.5-2.5	0.0	None		Red and brown coarse sand
		2.5-4.5	0.2	None		Coarse brown sand
		4.5-6.5	0.1	None		
		6.5-8.5	0.6	None		
		8.5-10.5	0.5	None		
		10.5-12.5	0.5	None		Coarse sand and gravel
		12.5-14.5	0.1	None		Coarse sand and gravel, dry
		18-20	0.0	None		Coarse sand, dry
		20-22	0.2	None		Coarse sand, dry
		24-26	0.1	None		Coarse red sand, moist
		28-30	1.9	None		
		32-34	0.8	None		
		36-38	0.5	None		
		40-42	0.4	None	TB-42-GW	Coarse red and brown sand, saturated
		44-46	0.3	None		

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-43	7/22/2013	0.5	1.1	--		Bottom of slab, top of soil
		0.5-2.5	2.2	None		Coarse red and brown sand
		2.5-4.5	5.2	Slight		
		4.5-6.5	8.2	Slight		
		6.5-8.5	2.7	None		
		8.5-10.5	2.3	None		
		10.5-12.5	1.7	None		
		12.5-14.5	0.9	None		
		14.5-16.5	1.1	None		
		20-22	7.5	Strong		
		22-24	6.9	Strong		
		24-26	5.1	Slight		
		28-30	2.1	Slight		
		32-34	17.6	Slight	TB-43 and TB-43-GW	Coarse red and brown sand, saturated
		36-38	9.6	Slight		
		40	--	--		Ground water sample

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-44	7/22/2013	0.5	0.7	--		Bottom of slab, top of concrete
		0.5-2.5	0.3	None		Coarse red and brown sand, dry
		2.5-4.5	0.4	None		
		4.5-6.5	0.1	None		Coarse red and brown sand, moist
		6.5-8.5	0.0	None		Coarse red and brown sand, saturated
		8.5-10.5	0.5	None		
		10.5-12.5	0.2	None		
		12.5-14.5	0.3	None		
		14.5-16.5	0.4	None		
		16.5-18.5	0.2	None		Coarse red and brown sand, dry
		18.5-20.5	0.3	None		
		20.5-22.5	0.3	None		Coarse red and brown sand, moist
TB-45	7/23/2013	1	0.3	--		Bottom of slab, top of soil
		0.5-2.5	0.0	None		Coarse red and brown sand, moist
		2.5-4.5	0.0	None		
		4.5-6.5	--	--		Concrete

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TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-46	7/23/2013	0.5	0.2	--		Bottom of slab top of soil
		0.5-2.5	0.0	--		Red and brown clayey sand
		2.5-4.5	0.0	Slight		Grey clayey sand, moist
		4.5-6.5	0.0	Slight		
		6.5-8.5	0.0	Slight		
		8.5-10.5	0.0	None		
		10.5-12.5	0.0	None		Grey saturated clay
		12.5-14.5	0.0	None		Red and brown clayey sand
		14.5-16.5	0.0	None		Coarse red sand, saturated
		16.5-18.5	0.2	None		Coarse red sand, dry
		18.5-20.5	0.1	None		
		20.5-22.5	0.0	None		
		24-26	0.5	None		
		28-30	0.2	None		
		32-34	1.8	None		
		36-38	1.1	None	TB-46-GW @ 40 ft	Coarse red sand, saturated
		42-44	4.2	None		
TB-47	7/23/2013	0.5	1.1	--		Bottom of slab, top of soil
		0.5-2.5	0.1	None		Black coarse sand and gravel, subgrade
		2.5-4.5	0.4	None		Coarse brown sand, dry
		12.5-14.5	0.2	None		Red and brown sand, saturated
		14.5-16.5	0.1	None		
		20-22	1.1	None		
		24-26	0.4	None	TB-47-GW @ 25 ft	

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TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-48	7/24/2013	20-22	220.4	Strong		Discolored grey coarse sand, moist
		22-24	233.7	Strong		
		24-26	292.2	Strong	TB-48	
		26-28	139.9	Slight		Very dense coarse red and brown sand
		28-30	14.6	Slight		Coarse red and brown sand
		30-32	8.5	Slight		Coarse red and brown sand, saturated
		32-34	2.3	None		Coarse red and brown sand, moist
		40	--	--	TB-48-GW	--
TB-49	7/24/2013	16-18	0.6	None		Coarse red and brown sand, saturated
		18-20	54.4	Slight		Discolored coarse red sand, moist
		20-22	38.9	Slight		
		22-24	120.3	Strong	TB-49	Red and brown coarse sand
		24-26	6.9	Very Slight		
		26-28	3.3	None		
TB-50	7/24/2013	16-18	8.7	None		Coarse red and brown sand, dry
		18-20	10.5	Very slight		
		20-22	29.7	Strong		
		22-24	43.7	Strong	TB-50	
		24-26	0.0	Slight		
		26-28	1.6	Slight		
TB-51	10/22/2013	16-18	0.2	None		Brown and orange medium sand, dry
		18-20	152.2	Slight	TB-51-19.5	Brown and orange medium sand, grey-green discoloration @ 19.5'
		20-22	0.4	None		Brown and orange medium sand, dry
		22-24	0.6	None		Brown and orange medium sand, trace clay
		24-26	0.3	None		
		30-32	0.2	None		

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TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-52	10/23/2013	16-18	4.5	None		red and brown medium sand
		18-20	3.6	Slight		
		20-21	131.0	strong		
		21-22	152.0	strong	TB-52-21	
		22-24	93.7	strong	TB-52-23	Red and brown clayey sand
		24-26	127.0	strong	TB-52-25	red and brown sand, trace clay
		26-28	17.9	slight		
		28-30	4.3	slight		
TB-53	10/23/2013	16-18	0.1	none		red and brown medium sand
		18-20	0.0	none		
		20-22	0.0	none		
		22-24	34.9	slight	TB-53-23	red and brown medium sand, green discoloration
		24-26	57.5	None	TB-53-24	
		26-28	0.1	None		red and brown medium sand
		28-30	2.5	None		
		33-35	0.7	None		red and brown clayey sand, saturated
TB-54	10/24/2013	20-22	0.0	none		red and brown sand
		22-24	91.9	slight	TB-54-23	red and brown clayey sand, grey-green discoloration
		24-26	0.6	slight		red and brown sand
		26-28	0.0	none		
		34-36	6.3	none		red and brown silty sand, saturated 34-35
TB-55	10/24/2013	20-22	0.0	none		red and brown sand
		22-24	0.0	none		
		24-26	0.0	none	could not sample	
		26-28	0.0	none	too much mud	

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-56	10/25/2013	20-22	0.2	none		red and brown sand
		22-23	0.0	none		
		23-25	0.5	none		red and brown silty sand, green discoloration
		25-26	0.0	none		red and brown sand
		27-29	0.0	none	GW collected at 35'	
TB-57	10/28/2013	4-5	0.7	Slight		grey/brown clayey sand
		16-18	0.0	none		no recovery
		18-19	0.0	none		red and brown sand
		19-20	0.0	none		cobbles
		21-22	0.0	none		red and brown hard sand, some gravel
		22-23	0.0	none		read and brown hard sand
		24-25	0.0	none	GW collected at 35'	red and brown hard sand
TB-58	10/28/2013	4-5	0.0	none		red and brown sand
		5-6	0.0	none		
		6-8	0.0	none		red and brown silty sand, green discoloration
		10-12	0.0	none		red and brown sand
		20-22	0.0	none		
		22-24	0.0	None		red brown and grey silty sand
		24-26	0.0	None	GW collected at 35'	
TB-59	10/29/2013	18-20	0.1	none		red and brown silty sand
		20-22	0.0	none		
		22-23	7.3	none	TB-59-23	
		23-24	4.5	none		
		24-25	0.0	none	GW collected at 35'	

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-60	12/7/2013	0-2	0.0	none		Brown fine sand
		2-4	0.0	slight		brown medium sand and gravel
		4-6	0.0	none		brown medium sand
		6-8	0.0	none		very hard red sand
		8-10	0.0	none		
		10-12	0.0	none		
		12-13	0.0	none		hard red sand
		13-15	0.4	none		
		15-16	0.0	none		very hard red sand
		16-17	0.4	none		
		17-18	0.5	none		
		18-19	0.0	none		
		19-20	0.0	none		
		20-21	0.0	none		
		21-22	0.0	none		
		22-23	0.0	none		
		23-24	0.0	none		
		24-26	0.1	none		
		26-27	0.6	none		
		27-28	1.2	none	GW collected at 33'	

TABLE 1
SOIL HEADSPACE SCREENING SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Boring ID	Sample Date	Sample Depth (ft bgs)	OVA-PID Reading (ppm)	Odor	Sample Collected	Soil Description
TB-61	12/8/2013	0-5		none		brown and red sand
		5-7	0.4	none		grey/green clayey sand
		7-9	0.6	none		grey/green clayey sand
		9-11	0.5	none		red and brown silty sand
		11-12	0.2	none		hard red and brown sand
		12-14	0.3	none		
		14-16	0.2	none		red and brown silty sand
		16-18	0.4	none		hard red sand
		18-20	0.2	none		
		20-22	0.3	none		very stiff red and brown sand
		22-24	0.1	none	TB-61-24	hard red and brown sand
		24-26	0.1	none		hard red silty sand
		26-27	0.1	none		
		27-28	0.2	none	GW collected at 31'	
		34'-10"				END OF BORING - ROCK ENCOUNTERED

Notes:
OVA-PID = Organic Vapor Analyzer Equipped with a Photoionization Detector
ft bgs = feet below ground surface
ppm = parts per million

Prepared by: AAM
Checked by: BKP
Reviewed by: MCC

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TABLE 2
SOIL ANALYTICAL SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Sample Number	Sample Depth/ Interval	Sample Date	Tetrachloroethene (PCE)	Trichloroethene (TCE)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride	Petroleum Range Organics
RSL			**110***	**6.4****	**200****	**690****	**1.7***	**NE**
TB-2	15	9/22/2010	0.0028 U	0.0032 U	0.0028 U	0.0034 U	0.0030 U	28.6
TB-3	4	9/22/2010	0.0027 U	0.0031 U	0.0027 U	0.0033 U	0.0030 U	4.9 U
TB-4	2	9/20/2010	0.0030 U	0.0034 U	0.0030 U	0.0037 U	0.0032 U	NA
TB-5	24	9/21/2010	0.0029 U	0.0033 U	0.0029 U	0.0036 U	0.0032 U	NA
TB-6	4	9/22/2010	0.0033 U	0.0037 U	0.0033 U	0.0041 U	0.0036 U	NA
TB-7	22	9/23/2010	0.0027 U	0.0031 U	0.0027 U	0.0033 U	0.0029 U	NA
TB-8	12	9/23/2010	0.0031 U	0.0035 U	0.0031 U	0.0038 U	0.0034 U	NA
TB-9	4	9/21/2010	0.0030 U	0.0034 U	0.0030 U	0.0037 U	0.0032 U	NA
TB-10	4	9/23/2010	0.0029 U	0.0033 U	0.0029U	0.0035 U	0.0031 U	25.0 U
TB-11	2	9/23/2010	0.0028 U	0.0031 U	0.0028 U	0.0034 U	0.0030 U	4.9 U
TB-12	5 - 6	9/23/2010	0.0032 U	0.0036 U	0.0032 U	0.0039 U	0.0035 U	5.5 U
TB-14	2 - 4	1/17/2011	0.0028 U	0.0031 U	0.0028 U	0.0034 U	0.0030 U	NA
TB-16	1 - 2	6/12/2013	0.0024 U	0.0027 U	0.0024 U	0.0029 U	0.0026 U	NA
TB-18	2 - 3	6/13/2013	0.0027 U	**0.0918**	0.0027 U	0.0034 U	0.0030 U	NA
TB-22	4 - 5	6/13/2013	0.0041 U	0.0046 U	0.0041 U	0.0050 U	0.0044 U	NA
TB-33	3 - 5	7/16/2013	0.0035 U	0.0039 U	0.0035 U	0.0043 U	0.0038 U	935
TB-41	20 - 22	7/17/2013	0.0031 U	**0.0222**	**0.0691**	0.0038 U	**0.0038 I**	NA
TB-43	32 - 34	7/22/2013	0.0025 U	**0.575**	**0.555**	**0.0043 I**	**0.0454**	NA
TB-48	24 - 26	7/24/2013	0.0026 U	**0.0032 I**	0.0026 U	0.0032 U	**0.0068**	NA
TB-49	22 - 24	7/24/2013	0.0024 U	0.0027 U	**0.0034 I**	0.0029 U	0.0026 U	NA
TB-50	22 - 24	7/24/2013	0.0021 U	0.0023 U	0.0021 U	0.0025 U	0.0022 U	NA
TB-51	18 - 20	10/22/2013	0.0029 U	0.0033 U	0.0029 U	0.0036 U	0.0031 U	NA
TB-52	20 - 22	10/23/2013	0.0030 U	**1.15**	**0.0311**	0.0037 U	0.0032 U	NA
TB-52	22 - 24	10/23/2013	0.0031 U	**6.27**	**0.172**	0.0038 U	**0.0131**	NA
TB-52	24 - 26	10/23/2013	0.0029 U	**1.63**	**0.0878**	0.0036 U	**0.0035 I**	NA
TB-53	23	10/23/2013	0.0029 U	0.0032 U	0.0029 U	0.0035 U	0.0031 U	NA
TB-53	24	10/23/2013	0.0027 U	0.0031 U	0.0027 U	0.0033 U	0.0029 U	NA
TB-54	23	10/24/2013	**0.0053**	**0.005**	**0.007**	0.0030 U	**0.0062**	NA
TB-59	23	10/29/2013	0.0038 U	0.0043 U	0.0038 U	0.0047 U	0.0041 U	NA

TABLE 2
SOIL ANALYTICAL SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Sample Number	Sample Depth/ Interval	Sample Date	Tetrachloroethene (PCE)	Trichloroethene (TCE)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride	Petroleum Range Organics
RSL			**110***	**6.4****	**200****	**690****	**1.7***	**NE**
TB-59-GW	35 - 40	10/29/2013	0.0116 U	0.0131 U	0.0116 U	0.0142 U	0.0125 U	NA
TB-61	24	12/8/2013	0.0013 U	0.0014 U	0.0013 U	0.0016 U	0.0014 U	NA
MW-13S-5	5	11/4/2013	0.0029 U	0.0033 U	0.0029 U	0.0036 U	0.0032 U	NA

Notes:
All analytical results reported as mg/kg (milligrams per kilogram)
U = Indicates the compound was analyzed for but not detected at a concentration greater than the shown MDL.
I = The reported value is between the laboratory MDL and the laboratory practical quantitation limit (PQL).
MDL = Method Detection Limit
RSLs are the EPA Regional Screening Levels for Industrial/Commercial Use dated November 2013.
NE - RSL was not established for this analyte
NA - constituent not analyzed
*RSL was set at the more stringent carcinogenic screening level
**RSL was set at the more stringent noncarcinogenic screening level
Bold denotes a detection above laboratory method detection limit
Sample depth interval is in feet below ground surface.

Prepared by: LAH
Checked by: BKP
Reviewed by: MCC

Golder Associates

TABLE 3
MONITORING WELL COMPLETION AND GROUNDWATER ELEVATION SUMMARY

Pfizer, Carolina Facility, Puerto Rico

WELL DESIGNATION	MW-01S			MW-02S			MW-03S			MW-04S			MW-05S			MW-06S			MW-07S		
DIAMETER		2	in		2	in		2	in		2	in		2	in		2	in		2	in
WELL DEPTH		68.4	ft		39.9	ft		39.9	ft		22.5	ft		32.7	ft		40	ft		38	ft
SCREEN INTERVAL		58.4 - 68.4	ft		29.9 - 39.9	ft		29.9 - 39.9	ft		12.5 - 22.5	ft		22.7 - 32.7	ft		30 - 40	ft		28 - 38	ft
TOC ELEVATION[1]		59.83	ft		53.16	ft		48.02	ft		35.36	ft		34.65	ft		41.92	ft		47.42	ft
SCREEN ELEVATION[1]		1.43 to -8.57	ft		23.26 to 13.26	ft		18.12 to 8.12	ft		22.86 to 12.86	ft		11.95 to 1.95	ft		11.92 to 1.92	ft		19.42 to 9.42	ft
DATE	ELEV	DTW	FP	ELEV	DTW	FP	ELEV	DTW	FP	ELEV	DTW	FP	ELEV	DTW	FP	ELEV	DTW	FP	ELEV	DTW	FP
2/2/2011	38.85	20.98		33.37	19.79		34.72	13.30		30.75	4.61		33.24	1.41		35.11	6.81		NI	NI	
10/17/2011	40.80	19.03		34.03	19.13		35.33	12.69		31.81	3.55		33.31	1.34		35.27	6.65		32.04	15.38	
9/12/2012	39.42	20.41		33.17	19.99		34.81	13.21		31.51	3.85		33.26	1.39		35.34	6.58		31.28	16.14	
4/17/2013	NM	NM		32.32	20.84		33.57	14.45		NM	NM		NM	NM		NM	NM		30.59	16.83	
12/6/2013	NM	NM		35.20	17.96		36.15	11.87		NM	NM		34.25	0.40		36.30	5.62		33.27	14.15	

WELL DESIGNATION	MW-08S			MW-09S			MW-10S			MW-11S			MW-12S			MW-13S			MW-14S		
DIAMETER		2	in		2	in		2	in		2	in		2	in		2	in		2	in
WELL DEPTH		40	ft		21.4	ft		40	ft		40	ft		27.5	ft		40	ft		40	ft
SCREEN INTERVAL		30 - 40	ft		11.4 - 21.4	ft		30 - 40	ft		30 - 40	ft		17.5 - 27.5	ft		30 - 40	ft		30 - 40	ft
TOC ELEVATION[1]		50.62	ft		41.96	ft		52.85	ft		52.82	ft		44.29	ft		55.81	ft		56.16	ft
SCREEN ELEVATION[1]		20.62 to 10.62	ft		30.56 to 20.56	ft		22.85 to 12.85	ft		22.82 to 12.82	ft		26.79 to 16.79	ft		25.81 to 15.81	ft		26.16 to 16.16	ft
DATE	ELEV	DTW	FP	ELEV	DTW	FP	ELEV	DTW	FP	ELEV	DTW	FP	ELEV	DTW	FP	ELEV	DTW	FP	ELEV	DTW	FP
2/2/2011	NI	NI		NI	NI		NI	NI		NI	NI		NI	NI		NI	NI		NI	NI	
10/17/2011	34.24	16.38		37.26	4.70		NI	NI		NI	NI		NI	NI		NI	NI		NI	NI	
9/12/2012	33.76	16.86		36.97	4.99		NI	NI		NI	NI		NI	NI		NI	NI		NI	NI	
4/17/2013	NM	NM		NM	NM		NI	NI		NI	NI		NI	NI		NI	NI		NI	NI	
12/6/2013	35.10	15.52		37.99	3.97		35.81	17.04		34.49	18.33		34.36	9.93		34.88	20.93		39.31	16.85	

TABLE 3
MONITORING WELL COMPLETION AND GROUNDWATER ELEVATION SUMMARY

Pfizer, Carolina Facility, Puerto Rico

WELL DESIGNATION	**MW-15S**			**MW-02D**			**MW-03D**			**MW-07D**		
DIAMETER	2		in	2		in	2		in	2		in
WELL DEPTH	32.5		ft	87.2		ft	69		ft	98		ft
SCREEN INTERVAL	22.5 - 32.5		ft	77.2 - 87.2		ft	69 - 79		ft	88 - 98		ft
TOC ELEVATION[1]	49.76		ft	52.89		ft	48.06		ft	46.92		ft
SCREEN ELEVATION[1]	27.26 to 17.26		ft	-24.31 to -34.31		ft	-20.94 to -30.94		ft	-41.08 to -51.08		ft
DATE	**ELEV**	**DTW**	**FP**	**ELEV**	**DTW**	**FP**	**ELEV**	**DTW**	**FP**	**ELEV**	**DTW**	**FP**
2/2/2011	NI	NI		34.73	18.16		35.07	12.99		NI	NI	
10/17/2011	NI	NI		35.28	17.61		35.61	12.45		33.85	13.07	
9/12/2012	NI	NI		34.43	18.46		35.12	12.94		33.04	13.88	
4/17/2013	NI	NI		33.27	19.62		33.82	14.24		31.91	15.01	
12/6/2013	33.31	16.45		36.07	16.82		36.44	11.62		34.72	12.20	

Notes:

[1] - Elevations referenced to US Geological Survey Benchmark with mean sea level datum as determined by Alex Hornedo & Associates.

in - inch NI - not installed
ft - feet DTW - depth to water (feet below top of casing)
TOC Elevation - top of casing elevation FP - free product (feet)
ELEV - elevation (feet) NM - not measured

Checked by: AAM
Reviewed by: MCC

TABLE 4
GROUNDWATER GRAB SAMPLE ANALYTICAL SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Sample Number	Sample Depth/ Interval	Sample Date	Tetrachloroethene (PCE)	Trichloroethene (TCE)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	1,2-Dichloroethene (Total)	Vinyl chloride	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene	Bromodichloromethane	Chlorobenzene	Chloroform	
MCL			**5**	**5**	**70**	**100**	**70***	**2**	**5**	**CCL 2**	**7**	**80****	**100**	**80****	**80****
TW-2	30'	9/22/2010	U	**10**	9.7	0.50 U	**9.9**	**1.9**	U	U	U	U	U	U	NM
TW-3	33'	9/22/2010	U	1.3	0.50 U	0.50 U	U	U	U	U	**1.5**	U	U	U	NM
TW-4	25'	9/20/2010	**88.4**	**26.5**	35.5	0.50 U	**35.6**	**5.2**	**0.96**	**1.4**	**5.9**	U	**1.5**	U	NM
TW-5	14'	9/21/2010	**55.1**	**15.9**	17.7	0.50 U	**17.9**	**1.5**	U	**1.3**	**4.3**	U	**0.81**	**0.62**	NM
TW-6	24'	9/22/2010	U	U	0.50 U	0.50 U	U	U	U	**0.67**	**0.62**	U	U	U	NM
TW-7	25'	9/23/2010	U	U	0.50 U	0.50 U	U	U	U	**4.1**	**1.1**	U	U	**0.77**	NM
TW-8	25'	9/3/2010	U	**0.57**	0.91 I	0.50 U	**0.91**	U	U	**0.92**	**0.98**	U	U	U	NM
TW-9	29'	9/21/2010	2	**338**	44.8	3.2	**48**	**6.9**	U	U	1.4	U	U	U	NM
TW-10	10'	9/23/2010	U	U	0.50 U	0.50 U	U	U	U	U	U	U	U	U	NM
TB-13-GW	28' - 38'	1/19/2011	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50U	0.27 U	0.50 U	0.50U	0.26 U
TB-14 GW	40' - 45'	1/17/2011	0.50 U	**4.3**	2.8 U	3.4 U	**1.2**	0.50 U	0.50 U	0.50 U	0.50 U	**4.5**	0.50 U	**28.3**	**1.8**
TB-15-GW	12' - 22'	1/20/2011	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	**1.0**	**1.1**	0.27 U	0.50 U	0.50 U	0.26 U
TB-18-GW	10'	6/13/2013	0.50 U	**2.3**	3.3	0.50 U	**3.3**	0.50 U	0.50 U	0.50 U	0.50 U	0.27 U	0.50 U	**0.5**	0.26 U
TB-41-GW	35'	7/18/2013	**1.4**	**348**	**1,960**	**232**	**2,190**	**187**	0.50 U	0.50 U	**10.1**	0.27 U	0.50 U	0.50 U	0.26 U
TB-42-GW	40'	7/19/2013	**0.67 I**	**206**	**530**	8.9	**539**	**171**	0.50 U	0.50 U	**5.3**	0.27 U	0.50 U	0.50 U	0.26 U
TB-43-GW	33'	7/22/2013	**0.57 I**	**1,350**	**2,000**	92.2	**2,090**	**452**	0.50 U	0.50 U	**39.7**	0.27 U	0.50 U	0.50 U	0.26 U
TB-46-GW	40'	7/23/2013	25.0 U	**4,020**	**3,860**	28.2 I	**3,880**	**742**	25.0 U	25.0 U	25.0 U	13.5 U	25.0 U	25.0 U	13.0 U
TB-47-GW	25'	7/23/2013	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	27.0 U	50.0 U	50.0 U	50.0 U
TB-48-GW	40'	7/24/2013	12.5 U	**1,930**	**3,160**	61.5	**3,220**	**738**	12.5 U	12.5 U	**27.2**	6.8 U	12.5 U	12.5 U	6.5 U
TB-51-GW	19.5'	10/22/2013	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.27 U	0.50 U	0.50 U	0.26U
TB-53-GW-T	35' - 40'	10/23/2013	**1.3**	**466**	**2,330**	63.4	**2,390**	**1,800**	0.50 U	0.50 U	**16.5**	0.27 U	0.50 U	0.50 U	0.26 U
TB-53-GW-R	55-60'	10/24/2013	0.50 U	**45.7**	**240**	3.0	**243**	**103**	0.50 U	0.50 U	**2.1**	0.27 U	0.50 U	0.50 U	0.26 U
TB-54-GW	31' - 36'	10/24/2013	**2.1**	**1,120**	**568**	4.7	**573**	**87**	0.50 U	0.50 U	**2.7**	0.27 U	0.50 U	**2.4**	0.26 U
TB-56-GW	35' - 40'	10/28/2013	**6.1**	**9,710**	**13,900**	**434**	**14,400**	**1,760**	0.50 U	0.50 U	**47.5**	0.27 U	0.50 U	0.50 U	0.26 U
			250 U	**10,300**	**16,500**	**250 U**	**16,500**	**1,420**	250 U	250 U	250 U	250 U	250 U	250 U	130 U
TB-57-GW	35' - 40'	10/28/2013	0.50 U	**1,520**	**2,950**	**9.1**	**2,960**	**371**	0.50 U	0.50 U	**2.7**	0.27 U	0.50 U	0.50 U	0.26 U
TB-58-GW	35' - 40'	10/28/2013	5.0 U	**301**	50.7	6.5 I	**57.3**	5.0 U	5.0 U	5.0 U	5.0 U	2.7 U	5.0 U	5.0 U	2.6 U
TB-60-GW	35' - 40'	12/8/2013	0.50 U	**71.1**	24	1.3	**25.4**	**4.2**	0.50 U	0.50 U	0.50 U	0.27 U	0.50 U	0.50 U	0.26 U
TB-61-GW	35' - 40'	12/8/2013	**3.2**	**19.7**	3.5	0.50 U	**3.5**	0.50 U	0.50 U	0.50 U	0.50 U	0.27 U	0.50 U	0.50 U	0.26 U

Notes:

Analytical results reported as µg/L (micrograms per liter)

U = Indicates the compound was analyzed for but not detected at a concentration greater than the shown MDL.

I = The reported value is between the laboratory MDL and the laboratory practical quantitation limit (PQL).

MDL = Method Detection Limit

Federal Maximum Contaminant Levels (MCLs) from http://water.epa.gov/drink/contaminants/index.cfm#List as of 10/11/10.

Bold denotes a detection above laboratory method detection limit

Shaded denotes an exceedance of the MCL

NM - Not Measured

Sample depth interval is in feet below ground surface.

* The results for 1,2-dichloroethene are for Total of *cis* and *trans* isomers. The Federal MCL of 70 µg/L is the value for the *cis* isomer as it is the more stringent value.

** The Federal MCL for Total Trihalomethanes is 80 µg/L

CCL 2 - no numeric standard available. This compound has been added to the Drinking Water Contaminant Candidate List for further evaluation to determine whether or not regulation with a National Primary Drinking Water Regulation is necessary.

Checked by: AAM
Reviewed by: MCC

Golder Associates

TABLE 5
GROUNDWATER MONITORING WELL ANALYTICAL SUMMARY
CONSTITUENTS OF CONCERN

Pfizer, Carolina Facility, Puerto Rico

Sample Location	Sample Date	Tetrachloroethene	Trichloroethene	1,1-Dichloroethene	cis-1,2-Dichloroethene	1,2-Dichloroethene (Total)*	Vinyl Chloride	Methane	Ethane	Ethene
MCL		*5*	*5*	*7*	*70*	*70*	*2*	*NA*	*NA*	*NA*
MW-01S	02/02/2011	**0.5**	**2.8**	**1.2**	0.50 U	0.50 U	0.50 U	NM	NM	NM
	10/17/2011	**0.64 I**	**3.2**	**0.80 I**	0.50 U	0.50 U	0.50 U	NM	NM	NM
	09/12/2012	**0.72 I**	**2.3**	0.50 U	0.50 U	0.50 U	0.50 U	**0.12 I**	0.20 U	**0.037 I**
MW-02S	02/02/2011	**1.4**	**1,630**	**9.9**	**1,490**	**1,500**	**303**	NM	NM	NM
	10/18/2011	**1.6**	**1,830**	**7.9**	**1,780**	**1,790**	**253**	NM	NM	NM
	09/11/2012	**1.4**	**1,090**	**7.7**	**1,200**	**1,200**	**222**	**410**	**5.3**	**4.3**
	04/17/2013	**1.5**	**776**	**9.4**	**1,280**	**1,290**	**130**	NM	NM	NM
	12/04/2013	**1.3**	**1,330**	**7.3**	**1,390**	**1,400**	**329**	**600**	**0.87**	**1.7**
MW-03S	02/02/2011	**85.4**	**20**	**6.9**	**32.2**	**32.6**	**4.3**	NM	NM	NM
	10/18/2011	**133**	**34.3**	**7.5**	**46.9**	**47.3**	**4.1**	NM	NM	NM
	09/12/2012	**110**	**30.0**	**7.5**	**46.6**	**46.8**	**4.2**	**1.0**	**0.19 I**	**0.14 I**
	04/17/2013	**68**	**37.9**	**9.8**	**54.4**	**54.9**	**3.5**	NM	NM	NM
	12/04/2013	**132**	**36.8**	**7.2**	**45.9**	**46.2**	**6.3**	**0.46**	**0.16 I**	**0.045 I**
MW-04S	02/02/2011	0.50 U	0.50 U	**0.5**	0.50 U	0.50 U	0.50 U	NM	NM	NM
	10/17/2011	0.50 U	0.50 U	**0.58 I**	0.50 U	0.50 U	0.50 U	NM	NM	NM
	09/12/2012	0.50 U	0.50 U	**0.54 I**	0.50 U	0.50 U	0.50 U	**9.1**	**0.010 I**	**0.027 I**
MW-05S	02/02/2011	0.50 U	**1.8**	**1.7**	**0.5**	**0.5**	0.50 U	NM	NM	NM
	10/17/2011	0.50 U	**2.4**	**0.74 I**	**0.59 I**	**0.59 I**	0.50 U	NM	NM	NM
	09/12/2012	0.50 U	**2.1**	**1.1**	**0.74 I**	**0.74 I**	0.50 U	**2.6**	**0.070 I**	**0.064 I**
	12/05/2013	0.50 U	**3.7**	**1.2**	**0.79 I**	**0.79 I**	0.50 U	**1.9**	0.018 U	**0.022 I**
MW-06S	02/02/2011	0.50 U	**19**	**7.4**	**4.1**	**4.1**	0.50 U	NM	NM	NM
	10/18/2011	0.50 U	**17.9**	**5.9**	**4.4**	**4.4**	0.50 U	NM	NM	NM
	09/11/2012	0.50 U	**17.8**	**5.0**	**3.5**	**3.5**	0.50 U	**3.0**	**0.017 I**	**0.052 I**
	12/05/2013	0.50 U	**26.0**	**6.3**	**4.4**	**4.5**	0.50 U	**3.3**	0.018 U	**0.030 I**

TABLE 5
GROUNDWATER MONITORING WELL ANALYTICAL SUMMARY
CONSTITUENTS OF CONCERN

Pfizer, Carolina Facility, Puerto Rico

Sample Location	Sample Date	Tetrachloroethene	Trichloroethene	1,1-Dichloroethene	cis-1,2-Dichloroethene	1,2-Dichloroethene (Total)*	Vinyl Chloride	Methane	Ethane	Ethene
MCL		*5*	*5*	*7*	*70*	*70*	*2*	*NA*	*NA*	*NA*
MW-07S	10/17/2011	**2.2**	**538**	**2.1**	**324**	**327**	**41.6**	NM	NM	NM
	09/11/2012	**2.1**	**467**	**2.7**	**309**	**312**	**77.2**	0.20 U	0.20 U	0.20 U
	04/17/2013	**3.0**	**375**	**4.1**	**403**	**408**	**70.8**	NM	NM	NM
	12/03/2013	**1.9**	**703**	**3.5**	**494**	**497**	**99.2**	**120**	**2.0**	**0.63**
MW-08S	10/17/2011	**25.9**	**12.1**	**2.3**	**10**	**10**	**2.1**	NM	NM	NM
	09/12/2012	**31.4**	**11.3**	**2.4**	**10.7**	**10.7**	0.50 U	**0.35**	**0.059 I**	**0.086 I**
	12/05/2013	**10.9**	**4.3**	**0.85 I**	**2.9**	**2.9**	0.50 U	**0.48**	0.018 U	**0.035 I**
MW-09S	10/17/2011	0.50 U	**14.3**	**9.2**	**0.99 I**	**0.99 I**	0.50 U	NM	NM	NM
	09/11/2012	0.50 U	**13.7**	**8.5**	**0.76 I**	**0.76 I**	0.50 U	**0.68**	0.20 U	**0.050 I**
	12/04/2013	0.50 U	**13.7**	**8.1**	**0.85 I**	**0.85 I**	0.50 U	**1.3**	0.018 U	**0.026 I**
MW-10S	12/03/2013	**29.7**	**11.6**	**2.8**	**10.8**	**10.8**	**1.3**	**1.0**	**0.37**	**0.032 I**
MW-11S	12/03/2013	0.50 U	**62.6**	0.50 U	**8.1**	**8.8**	**1.3**	**8.6**	**2.0**	**0.84**
MW-12S	12/02/2013	**28.3**	**109**	**2.9**	**44.0**	**44.6**	**1.6**	**4.2**	**0.49**	**0.53**
MW-13S	12/02/2013	**3.5**	**3,510**	**12.1**	**2,610**	**2,640**	**429**	**550**	**14**	**13**
Duplicate	12/02/2013	**3.2**	**2,770**	**13.9**	**1,890**	**1,920**	**324**	**540**	**14**	**14**
MW-14S	12/04/2013	0.50 U	**1.2**	0.50 U	0.50 U	0.50 U	0.50 U	**12.0**	**5.2**	**0.13 I**
MW-15S	12/02/2013	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	**52**	**11**	**2.9**
MW-02D	02/02/2011	0.50 U	**523**	**4.6**	**431**	**439**	**53.6**	NM	NM	NM
	10/18/2011	0.50 U	**310**	**3.3**	**716**	**734**	**32.0**	NM	NM	NM
	09/11/2012	0.50 U	**205**	**2.9**	**379**	**391**	**34.2**	**430**	**0.30**	**1.4**
	04/17/2013	0.50U	**104**	**4.3**	**257**	**303**	**20.1**	NM	NM	NM
	12/03/2013	0.50 U	**347**	**4.9**	**653**	**671**	**46.0**	**350**	**5.0**	**3.7**

TABLE 5
GROUNDWATER MONITORING WELL ANALYTICAL SUMMARY
CONSTITUENTS OF CONCERN

Pfizer, Carolina Facility, Puerto Rico

Sample Location	Sample Date	Tetrachloroethene	Trichloroethene	1,1-Dichloroethene	cis-1,2-Dichloroethene	1,2-Dichloroethene (Total)*	Vinyl Chloride	Methane	Ethane	Ethene
MCL		***5***	***5***	***7***	***70***	***70***	***2***	***NA***	***NA***	***NA***
MW-03D	02/02/2011	0.50 U	**1.9**	**0.5**	**1.2**	0.50 U	0.50 U	NM	NM	NM
	10/18/2011	0.50 U	**2.4**	**0.57 I**	**1.7**	**1.8**	0.50 U	NM	NM	NM
	09/12/2012	0.50 U	**1.2**	0.50 U	**1.1**	**1.2**	0.50 U	**9.4**	**0.030 I**	**0.15 I**
	04/17/2013	0.50U	**1.6**	0.5	**1.5**	**2.1**	0.50U	NM	NM	NM
	12/04/2013	**5.4**	**1.3**	0.70 I	**1.6**	**2.2**	0.50 U	**7.7**	**0.048 I**	**0.36**
MW-07D	10/17/2011	0.50 U	**12.5**	0.50 U	**116**	**134**	**1.9**	NM	NM	NM
	09/11/2012	0.50 U	0.50 U	0.50 U	**90.5**	**109**	**1.7**	**140**	**0.080 I**	**0.73**
	04/17/2013	0.50 U	**7.8**	0.50 U	**95.4**	**122**	**2.3**	NM	NM	NM
	12/03/2013	0.50 U	**3.1**	0.50 U	**114**	**139**	**2.4**	**340**	**0.051 I**	**2.1**
Production Well	02/02/2011	**3.8**	**4.9**	**1.5**	**7.8**	0.50 U	0.50 U	NM	NM	NM
	10/18/2011	**3.6**	**4.0**	**1.1**	**7.4**	**8.8**	0.50 U	NM	NM	NM
Equipment Blank	12/02/2013	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	**0.38**	0.018 U	**0.026 I**

Notes:

All analytical results reported in micrograms per liter (µg/L)

MCL = Federal Maximum Contaminant Level from http://water.epa.gov/drink/contaminants/index.cfm#List as of 10/11/10

U = Indicates the compound was analyzed for but not detected at a concentration greater than the shown MDL.

I = The reported value is between the laboratory MDL and the laboratory practical quantitation limit (PQL).

MDL = Method Detection Limit

NM = Not Measured

Bold denotes a detection above laboratory method detection limit

Shaded = Concentration is greater than MCL

*Total 1,2-Dichloroethene is for the *cis* and *trans* isomers.

The Federal MCL of 70 µg/l is for the *cis* isomer as it is the more stringent value.

Prepared by: AAM
Checked by: BKP
Reviewed by: MCC

Golder Associates

TABLE 6
GROUNDWATER CHEMISTRY ANALYTICAL SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Sample Location	Sample Date	Total Iron	Iron, Dissolved	Total Manganese	Manganese, Dissolved	Alkalinity	Nitrate as N	Nitrite as N	Nitrogen, NO2 + NO3	Chloride	Sulfate	Biological Oxygen Demand	Chemical Oxygen Demand	Total Organic Carbon	pH	Temperature	Conductivity	Dissolved Oxygen	Turbidity	Oxidation Reduction Potential
MCL		**300***	**-**	**50***	**-**	**-**	**10**	**1**	**-**	**250***	**250***	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Units		**(µg/L)**	**(µg/L)**	**(µg/L)**	**(µg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(S.U.)**	**(°C)**	**(µS/cm)**	**(mg/L)**	**(NTUs)**	**(mV)**
MW-01S	02/02/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.94	28.98	951	0.61	< 10	88.1
	10/17/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.74	29.24	985	0.45	17.9	61.2
	09/12/2012	**46.1**	20.0 U	**156**	2.5 U	**291**	NM	NM	**0.92**	**73.8**	**53.5**	2.0 U	12.5 U	**1.2**	7.26 J	30.72	941	0.47	6.30 J	-54.4 J
MW-02S	02/02/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.65	28.89	1,464	0.77	> 1,000	52.3
	10/18/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.54	27.13	1,328	0.99	18.9	124.6
	09/11/2012	20.0 U	20.0 U	**116**	**116**	**385**	NM	NM	**0.18**	**165**	**37.5**	2.0 U	**27.6**	**1.7**	8.97 J	29.93	1,272	0.75	0.74 J	111.9 J
	04/17/2013	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.67	29.27	1,271	0.47	NM	125.0
	12/03/2013	**218**	**119**	**79.0**	**78.4**	**387**	**0.86**	0.072 U	**0.86**	**166**	**49.8**	NM	NM	**1.9**	6.66	27.63	1,311	0.57	10.2	82.0
MW-03S	02/03/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	7.03	28.75	1,122	0.84	NM	-2.8
	10/18/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.68	29.92	934	0.64	47.6	34.5
	09/12/2012	20.0 U	20.0 U	**758**	**19.7**	**312**	NM	NM	**0.19**	**102**	**37.9**	2.0 U	**17.9 I**	**1.4**	6.97	30.41	1,018	0.32	0.49 J	60.9 J
	04/17/2013	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.67	29.52	953	0.55	152.8	91.3
	12/04/2013	**246**	20.0 U	**571**	**374**	**260**	**0.24**	**0.0066 I**	**0.24 I**	**92.3**	**40.7**	NM	NM	**1.5**	6.62	28.88	658	0.28	NM	69.3
MW-04S	02/02/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.54	28.91	846	0.63	> 1,000	1.5
	10/17/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.37	29.77	707	0.91	16.8	122.6
	09/12/2012	**191**	20.0 U	**191**	**4.0 I**	**205**	NM	NM	**0.61**	**73.6**	**28.9**	2.0 U	12.5 U	0.50 U	6.78	3.02 J	715	0.44	3.02 J	95.3 J
MW-05S	02/02/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.45	28.53	887	0.56	NM	44.6
	10/17/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.26	29.68	661	0.83	15.1	134.5
	09/12/2012	**2,600**	20.0 U	**134**	**3.6 I**	**203**	NM	NM	**0.36**	**62.9**	**21.1**	2.0 U	**22.4**	**0.72 I**	6.86	30.15	656	0.38	1.23 J	-6.0 J
	12/05/2013	**720**	**876.0**	**97.7**	**106**	**233**	**0.42**	**0.011 I**	**0.42 I**	**61.9**	**24.7**	NM	NM	**1.1**	6.49	28.86	490	0.92	17.12	68.1

TABLE 6
GROUNDWATER CHEMISTRY ANALYTICAL SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Sample Location	Sample Date	Total Iron	Iron, Dissolved	Total Manganese	Manganese, Dissolved	Alkalinity	Nitrate as N	Nitrite as N	Nitrogen, NO2 + NO3	Chloride	Sulfate	Biological Oxygen Demand	Chemical Oxygen Demand	Total Organic Carbon	pH	Temperature	Conductivity	Dissolved Oxygen	Turbidity	Oxidation Reduction Potential
MCL		300*	-	50*	-	-	10	1	-	250*	250*	-	-	-	-	-	-	-	-	-
Units		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(S.U.)	(°C)	(µS/cm)	(mg/L)	(NTUs)	(mV)
MW-06S	02/02/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.44	28.52	1,053	0.92	< 10	60.1
	10/18/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.41	29.17	892	0.57	5.89	62.7
	09/11/2012	**119**	20.0 U	**366**	**284**	**279**	NM	NM	**0.036 I**	**93.8**	**27.3**	**2.2**	**18.1 I**	**0.91 I**	8.59 J	29.85	890	0.32	3.95 J	201.8 J
	12/05/2013	**112**	20.0 U	**326**	**22.7**	**277**	**0.032 I**	**0.092 I**	**0.032 I**	**95.5**	**31.5**	NM	NM	**0.76 I**	6.50	28.97	657	0.26	3.72	48.6
MW-07S	10/17/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.49	28.65	1,100	1.65	0.61	199.6
	09/11/2012	20.0 U	20.0 U	**16.0**	**15.1**	**327**	NM	NM	**0.12**	**153**	**33.4**	**2.5**	**19.8 I**	**1.8**	8.87 J	28.22	1,164	0.40	0.39 J	191.9 J
	04/17/2013	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.69	27.83	1,109	0.48	5.09	-195.6
	12/03/2013	20.0 U	20.0 U	**19.0**	**18.7**	**326**	**0.91**	0.072 U	**0.91**	**132**	**52.4**	NM	NM	**2.3**	6.68	27.46	1,137	0.49	1.11	87.3
MW-08S	10/17/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.40	30.39	818	1.26	36.7	118.3
	09/12/2012	**304**	**37.2 I**	**171**	**3.5 I**	**210**	NM	NM	**0.89**	**97.2**	**37.1**	2.0 U	**18.5 I**	**1.2**	6.63	28.97	838	0.83	7.40 J	178.5 J
	12/05/2013	**6,170**	**65.1**	**171**	**45.8**	**127**	**0.23**	**0.062**	**0.30 I**	**25.6**	**14.9**	NM	NM	**1.2**	7.18	27.64	233	6.27	122	61.4
							.													
MW-09S	10/17/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.29	30.59	741	0.88	86.9	131.1
	09/11/2012	20.0 U	20.0 U	**1,280**	**1,170**	**230**	NM	NM	**0.24**	**64.7**	**36.5**	2.0 U	**12.7 I**	1.0 I	8.39 J	30.20	737	0.25	0.28 J	239.8 J
	12/04/2013	**394**	20.0 U	**1,390**	**1,370**	**219**	**0.31**	**0.0091 I**	**0.31 I**	**63.9**	**39**	NM	NM	0.94 I	6.37	29.06	539	0.37	6.02	0.5
MW-10S	12/03/2013	**357**	**132**	**389**	**389**	**197**	**0.66**	0.036 U	**0.66**	**84.3**	**43.1**	NM	NM	**1.8**	6.43	29.34	771	0.33	NM	56.1
MW-11S	12/03/2013	**1,970**	**395.0**	**708**	**705**	**226**	**2.6**	0.036 U	**2.7**	**85.9**	**49.9**	NM	NM	**2.3**	6.52	28.31	847	0.24	18.9	75.8
MW-12S	12/02/2013	**239**	20.0 U	**1,170**	**1,260**	**305**	**1.3**	0.072 U	**1.3**	**143**	**50.2**	NM	NM	**1.2**	6.68	28.73	1,103	0.28	6.81	33.7
MW-13S	12/02/2013	**421**	20.0 U	**253**	**259**	**178**	**1.4**	**0.082**	**1.5**	**58.7**	**106**	NM	NM	**2.5**	6.87	26.82	873	0.40	16.8	36.4

Golder Associates

TABLE 6
GROUNDWATER CHEMISTRY ANALYTICAL SUMMARY

Pfizer, Carolina Facility, Puerto Rico

Location	Date	Total Iron	Iron, Dissolved	Total Manganese	Manganese, Dissolved	Alkalinity	Nitrate as N	Nitrite as N	Nitrogen, NO2 + NO3	Chloride	Sulfate	Biological Oxygen Demand	Chemical Oxygen Demand	Total Organic Carbon	pH	Temperature	Conductivity	Dissolved Oxygen	Turbidity	Oxidation Reduction Potential
MCL		300*	-	50*	-	-	10	1	-	250*	250*	-	-	-	-	-	-	-	-	-
Units		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(S.U.)	(°C)	(µS/cm)	(mg/L)	(NTUs)	(mV)
MW-14S	12/04/2013	**2,380**	35.1 I	**1,180**	**1,080**	**185**	**0.58**	**0.046 I**	**0.63**	**23.3**	**42.6**	NM	NM	**1.8**	6.37	29.56	419	1.03	NM	40.6
MW-15S	12/02/2013	**4,660**	20.0 U	**2,240**	**1,940**	**517**	0.086 U	0.072 U	0.086 U	**74.2**	**82.7**	NM	NM	**3.3**	7.08	27.23	1,426	1.02	10.5	10.1
MW-02D	02/02/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.85	29.04	1,519	0.47	< 10	-18.9
	10/18/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.77	27.24	1,541	0.68	6.36	-55.7
	09/11/2012	**320**	20.0 U	**398**	390	**420**	NM	NM	0.025 U	**196**	**42.6**	**2.1**	**26.6**	**1.1**	9.02 J	29.24	1,558	0.20	0.65 J	-65.0 J
	04/17/2013	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.94	28.45	1,483	2.11	NM	-98.8
	12/03/2013	**435**	**304**	**397**	**394**	**453**	0.086 U	0.072 U	0.086 U	**194**	**52.4**	NM	NM	**1.4**	6.89	27.19	1,471	0.79	0.46	-125.7
MW-03D	02/03/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.97	28.73	1,538	0.45	NM	-37.0
	10/18/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.82	28.75	1,304	0.60	7.71	-40.0
	09/12/2012	**640**	**26.2 I**	**358**	**2.5 I**	**404**	NM	NM	0.025 U	**148**	**41.6**	2.0 U	**21.0**	**1.2**	7.29 J	28.89	1,300	0.37	2.92 J	-72.9 J
	04/17/2013	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.93	28.35	1,211	1.35	2.21	-26.0
	12/04/2013	**554**	**94.8**	**358**	**72.8**	**384**	0.029 U	0.0054 U	0.025 U	**149**	**46.5**	NM	NM	**1.2**	6.96	28.30	942	0.72	NM	-157.0
MW-07D	10/17/2011	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.89	28.39	1,373	0.73	1.03	-51.3
	09/11/2012	**725**	20.0 U	**250**	**228**	**376**	NM	NM	0.025 U	**172**	**53.7**	2.0 U	**23.2**	**1.4**	9.09 J	27.86	1,443	0.29	0.97 J	-118.1 J
	04/17/2013	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.90	27.46	1,333	0.46	7.88	-179.1
	12/03/2013	**2,220**	**491**	**258**	**245**	**309**	0.086 U	0.072 U	0.086 U	**156**	**54.4**	NM	NM	**1.4**	7.12	27.13	1,088	0.25	31.7	-188.2

Notes:
mV = millivolts
* = secondary MCL (SMCL)
µg/L = micrograms per liter
mg/L = milligrams per liter
S.U. = standard units
°C = degrees Celsius
µS/cm = microsiemens per centimeter
NTUs = nephelometric turbidity units

U = Indicates the compound was analyzed for but not detected at a concentration greater than the shown MDL.
I = The reported value is between the laboratory MDL and the laboratory practical quantitation limit (PQL).
J - Calibration result was outside the acceptable criteria for standard range
MDL = Method Detection Limit
NM = Not Measured
Bold denotes a detection above laboratory method detection limit
Shaded = Concentration is greater than MCL
MCL = Federal Maximum Contaminant Level from http://water.epa.gov/drink/contaminants/index.cfm#List as of 10/11/10

Prepared by: AAM
Checked by: BKP
Reviewed by: MCC

TABLE 7
REMEDIAL ALTERNATIVES EVALUATION

Pfizer, Carolina Facility, Puerto Rico

Remediation Technology	Feasibility	Implementability	Reliability	O&M Requirements	General Cost	Schedule	Potential Health/Environmental Impacts
Soil Remediation (Unsaturated Zone)							
Soil-Vapor Extraction	Vadose zone typically 20 to 40 feet in thickness Favorable technology for remediation of site-specific soils	Space available for trailer-mounted unit Developed area has access to power	SVE proven effective in similar environments Contemporary SVE systems are reliable and efficient	Monthly Maintenance Quarterly to semi-annual monitoring and reporting	Moderate	Design and installation in roughly 3 to 4 months Remediation time typically 2 to 4 years in condition similar to this site	Protective of human health and the environment as long as adequate monitoring is performed to monitor contaminant concentrations to prevent exposures to potential receptors
Soil Excavation	Various techniques capable of source removal at varying depths	Limited to areas outside of structure, northern side impractical May need building support to excavate near structure	Excavation is typically the most efficient means of mass removal, where feasible Highly reliable	O&M not required Confirmation samples collected during excavation	Moderate to High, depending on extent and waste characterization	Excavation completion within 4 to 8 weeks after work plan approval	Protective of human health and the environment since exposure pathway to potential receptors is reduced or eliminated
In Situ Chemical Oxidation	Favorable technology for remediation of site-specific soils; bench-scale treatability testing is useful in selecting the appropriate oxidant and loading rates; whereas, pilot field studies are useful in determining the optimum oxidant delivery mechanism means and methods.	Adequate space Adequate infrastructure	Moderate for spot treatment; low for widespread injections; short lifespan would limit the radii of influence and require close spacing of injection points and numerous reinjections.	Multiple oxidant compound injections likely.	Moderate	Dependent on extent of impacted soil.	Potential safety concerns in implementing technology; may increase mobility of naturally occurring metals and increase dissolved metal concentrations in the groundwater.
Groundwater Remediation							
Monitored Natural Attenuation	Existing robust bioremediation	Adequate space Adequate infrastructure Simple implementation	Good track record for site-specific geochemical conditions No equipment needed	No O&M Periodic sampling	Low	Immediate implementation Unlikely to achieve remedial objectives within reasonable timeframe	Protective of human health and the environment as long as adequate monitoring is performed to monitor contaminant concentrations and plume migration to prevent exposures to potential receptors
Enhanced Bioremediation	Existing robust bioremediation Can be used in conjunction with monitored natural attenuation	Adequate space Adequate infrastructure Simple implementation	Good track record for site-specific geochemical conditions Reliable equipment	Periodic injections Periodic monitoring	Moderate	12 to 18 months injections 18 to 24 months to reach remedial objectives	Protective of human health and the environment as long as adequate monitoring is performed to monitor contaminant concentrations and plume migration to prevent exposures to potential receptors
Air Sparging	Inefficient in widely heterogeneous subsurface Could spread contaminants Would oxygenate the groundwater and inhibit natural bioremediation	Adequate space Adequate infrastructure Simple implementation	Air flow through saturated zone may not be uniform and there can be uncontrolled movement of potentially harmful vapors; soil heterogeneity may cause some zones to be relatively unaffected; mounding effects may cause groundwater contaminants to migrate to previously unimpacted areas; low permeability zones at site may limit its effectiveness	Monthly Maintenance Quarterly to semi-annual monitoring and reporting	Moderate	Design and installation in roughly 3 to 4 months Unlikely to achieve remedial objectives within reasonable timeframe	May not be protective of human health due to the potential for uncontrolled movement of potentially harmful vapors

TABLE 7
REMEDIAL ALTERNATIVES EVALUATION

Pfizer, Carolina Facility, Puerto Rico

Remediation Technology	Feasibility	Implementability	Reliability	O&M Requirements	General Cost	Schedule	Potential Health/Environmental Impacts
Groundwater Remediation (continued)							
Thermal Treatment	May be effective in saturated overburden material; may be inefficient in bedrock groundwater	Adequate space	Thermal treatment proven to enhance mass removal from saturated soil and reduce treatment duration	Monthly Maintenance	High	Design and installation in roughly 3 to 4 months (can combine with SVE)	May not be protective of human health due to the potential for uncontrolled movement of potentially harmful vapors; elevated groundwater concentrations may remain for 2+ years
	Potential vapor intrusion & settlement concerns	Adequate infrastructure	Conductance methods more reliable and cost effective than other thermal methods	Quarterly to semi-annual monitoring and reporting		Remediation time typically 8 to 18 months	
		Simple implementation	May be inefficient in bedrock groundwater				
Zero Valent Iron	Effective in degrading chlorinated volatile organic compounds and stimulating reducing environment	Adequate space	Proven effective in similar environments	Periodic injections	Moderate to High	Design and installation in roughly 3 to 4 months	Protective of human health and the environment as long as adequate monitoring is performed to monitor contaminant concentrations and plume migration to prevent exposures to potential receptors
	Can be used in conjunction with enhanced bioremediation and monitored natural attenuation	Adequate infrastructure	Reliable equipment	Periodic monitoring		18 to 24 months to reach remedial objectives	
		Simple implementation					
Permeable Reactive Barrier	Effective in preventing downgradient migration by degrading chlorinated volatile organic compounds and stimulating reducing environment	Limited space and uneven terrain along northern property boundary	Effective in preventing downgradient migration by degrading chlorinated volatile organic compounds	Periodic injections	High	Design and installation in roughly 6 months	Protective of human health and the environment as long as adequate monitoring is performed to monitor contaminant concentrations and plume migration to prevent exposures to potential receptors
	Would require installation of infrastructure in bedrock at the northern property boundary	Difficult implementation due to installation in bedrock and low groundwater flow velocity in bedrock	Reliable equipment	Long-term periodic monitoring		Assuming source area depletion, 10+ years to reach remedial objectives	

Notes:
O&M = operations and maintenance
SVE = soil vapor extraction

TABLE 8
INITIAL PRE-RD FIELD TEST INJECTION PROGRAM

Pfizer, Carolina Facility, Puerto Rico

Injection Location	Treatment Thickness (feet)	Sodium Lactate (kg)	Sodium Lactate Solution[A] (kg)	Sodium Lactate Solution[B] (liters)	Injection Water (gallons)	Flush Water (gallons)	Total Injection Volume (gallons)
FIELD TEST AREA A							
INJ-1	45	12	20	15	1,000	100	1,100
INJ-2	45	12	20	15	1,000	100	1,100
INJ-3	45	12	20	15	1,000	100	1,100
FIELD TEST AREA B							
INJ-4	10	6	10	8	1,000	100	1,100
INJ-5	10	6	10	8	1,000	100	1,100
INJ-6	10	6	10	8	1,000	100	1,100
FIELD TEST AREA C							
DPT-1	25	12	20	15	250	50	300
DPT-2	25	12	20	15	250	50	300
DPT-3	25	12	20	15	250	50	300
DPT-4	25	12	20	15	250	50	300
DPT-5	25	12	20	15	250	50	300
DPT-6	25	12	20	15	250	50	300
DPT-7	25	12	20	15	250	50	300
DPT-8	25	12	20	15	250	50	300
	Total	**150**	**250**	**188**	**8,000**	**1,000**	**9,000**

Notes:

[A]Sodium lactate sold as food-grade 60% solution by mass

[B]Density of sodium lactate solution assumed to be 1,330 kilograms per cubic meter per material safety data sheet

kg = kilogram

lbs = pounds

gpm = gallons per minute

Checked by: MCC
Reviewed by: EAK

Golder Associates

TABLE 9
PERFORMANCE MONITORING PLAN

Pfizer, Carolina Facility, Puerto Rico

Well ID	Screen Interval (ft)	Monitoring Event	VOCs	Alkalinity	Nitrogen, $NO_2 + NO_3$	Chloride	Sulfate	Total Organic Carbon	Methane	Ethane	Ethene	pH	Temperature	Conductivity	Dissolved Oxygen	Turbidity	Oxidation Reduction Potential
		EPA Method	8260	SM 2320B	300.0	300.0	300.0	SM 5310B	RSK 175	RSK 175	RSK 175	Field	Field	Field	Field	Field	Field
FIELD TEST AREA A																	
MW-07S	28 - 38	Month 1	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 2	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 3	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Months 4 - 6[A]	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
MW-07D	88 - 98	Month 1	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 2	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 3	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Months 4 - 6[A]	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
FIELD TEST AREA B																	
MW-02S	29.9 - 39.9	Month 1	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 2	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 3	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Months 4 - 6[A]	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
MW-02D	77.2 - 87.2	Month 1	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 2	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 3	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Months 4 - 6[A]	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
MW-16S	30 - 40	Baseline	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Month 1	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 2	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 3	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Months 4 - 6[A]	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X

TABLE 9
PERFORMANCE MONITORING PLAN

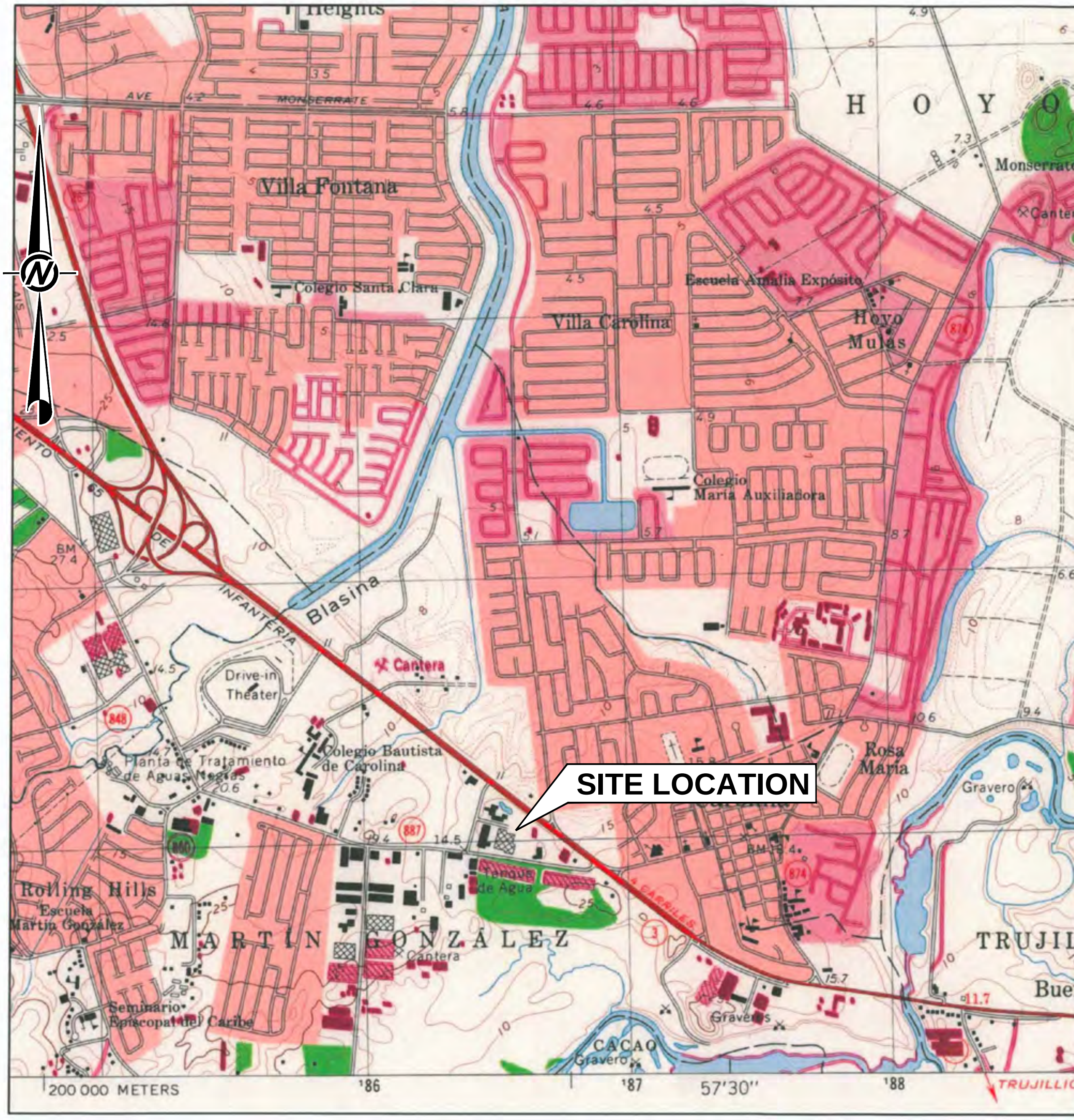
Pfizer, Carolina Facility, Puerto Rico

Well ID	Screen Interval (ft)	Monitoring Event	VOCs	Alkalinity	Nitrogen, $NO_2 + NO_3$	Chloride	Sulfate	Total Organic Carbon	Methane	Ethane	Ethene	pH	Temperature	Conductivity	Dissolved Oxygen	Turbidity	Oxidation Reduction Potential
		EPA Method	8260	SM 2320B	300.0	300.0	300.0	SM 5310B	RSK 175	RSK 175	RSK 175	Field	Field	Field	Field	Field	Field
FIELD TEST AREA C																	
MW-13S	30 - 40	Month 1	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 2	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 3	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Months 4 - 6[A]	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
MW-17S	30 - 40	Baseline	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Month 1	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 2	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 3	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Months 4 - 6[A]	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
MW-18S	50 - 60	Baseline	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Month 1	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 2	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Month 3	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X
		Months 4 - 6[A]	X	--	--	--	--	X	X	X	X	X	X	X	X	X	X

Notes:
[A]Samples will be collected as necessary during Months 4 - 6
Performance monitoring results will be reviewed through out the monitoring period and the plan may be adjusted based on available results.
X - Parameter measured or analyzed
-- - not sampled or analyzed
VOC - volatile organic compound
ft bgs - feet below ground surface

Checked by: MCC
Reviewed by: EAK

FIGURES



2,000 0 2,000

APPROXIMATE SCALE FEET

REFERENCES

1.) USGS TOPOGRAPHIC MAP. 7.5 MINUTE QUADRANGLE MAP SERIES: CAROLINA, PUERTO RICO QUADRANGLE, DATED 1969, PHOTOREVISED 1982.

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW
0						

PROJECT

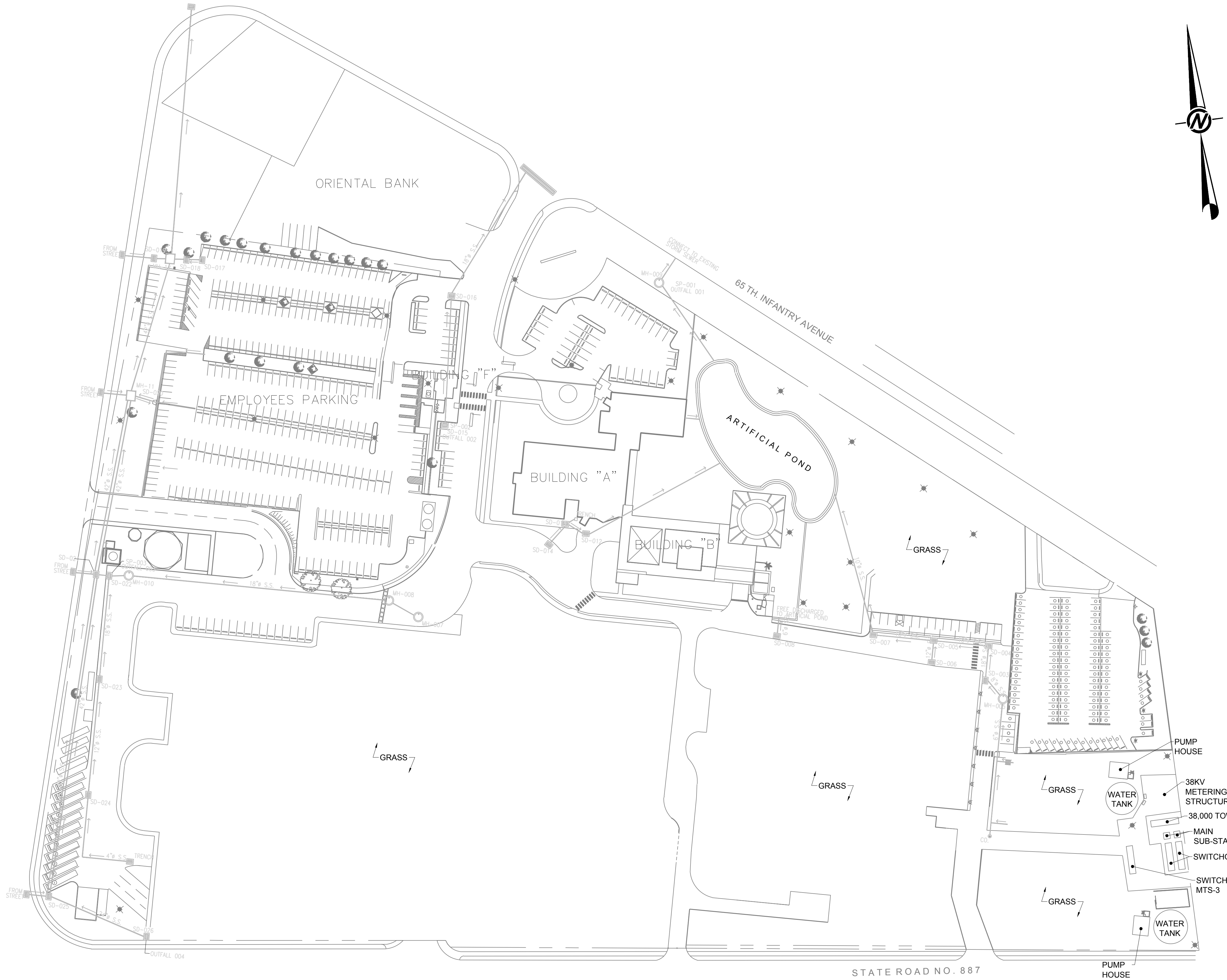
Pfizer
CAROLINA, PUERTO RICO

TITLE

SITE LOCATION MAP

Golder Associates	PROJECT No.		103-82746	FILE No. 10382746-R010
	DESIGN	MCC	01/30/14	SCALE AS SHOWN
	CADD	MRM	01/31/14	**FIGURE 1**
	CHECK	KAB	05/15/14	
	REVIEW	LAH	05/15/14	

N:\File\2010\103-82746 Pfizer-Carolina Phase II\R - Remedial Action Plan\Active Drawings\10382746-R010.dwg | Layout: TB-Report-PS-A | Modified: rmuise 05/15/2014 8:56 AM | Plotted: rmuise 05/15/14| Jacksonville, FL



LEGEND

STORM WATER LINE

STORM DRAIN (SD)

STORM WATER MANHOLE (MH)

DRAIN FLOW

BUILDING SUMMARY	
BUILDING NUMBER	USE
A	Human Resources, Training Offices, Purchasing, Materials Department
B	Cafeteria, Medical Department, Employee Center
F	Security Guard House

NOTES

1.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

120 0 120

APPROXIMATE SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

Pfizer
CAROLINA, PUERTO RICO

TITLE

SITE PLAN

Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746	FILE No.	10382746-R011
DESIGN	MCC	01/30/14	SCALE AS SHOWN	REV. 0
CADD	BCL	01/31/14		
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		

FIGURE 2

Drawing File: 10382746-R011.dwg May 15, 2014 - 10:06am

LEGEND

- TEMPORARY BORING LOCATION (SEPT. 2010 & JAN. 2011)
- TEMPORARY BORING LOCATION ADVANCED < 16.5 FT. (JULY 2013)
- TEMPORARY BORING LOCATION ADVANCED ≥ 16.5 FT. (JULY 2013)
- TEMPORARY BORING LOCATION ADVANCED ≥ 16.5 FT. (OCT-NOV. 2013)
- TEMPORARY BORING LOCATION ADVANCED ≥ 16.5 FT. (DEC. 2013)
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- OCTOBER 2013 EXCAVATION AREA

NOTES

1.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

Pfizer
CAROLINA, PUERTO RICO

TITLE

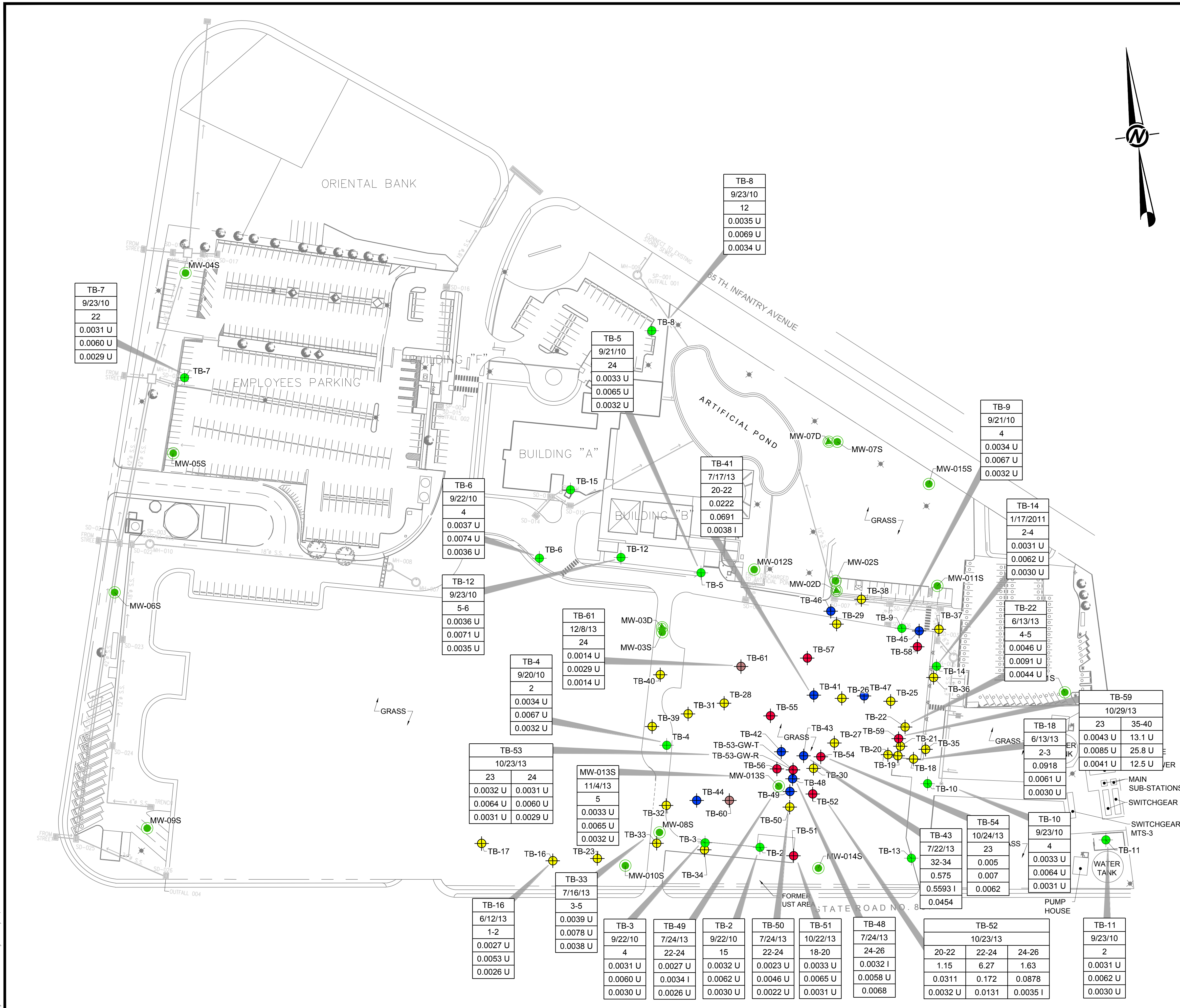
SOIL BORING AND MONITORING WELL LOCATION MAP

Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746	FILE No.	10382746-R012
DESIGN	MCC	01/30/14	SCALE AS SHOWN	REV. 0
CADD	BCL	01/31/14		
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		

FIGURE 3

Drawing file: 10382746-R012.dwg May 15, 2014 - 10:07am



LEGEND

- TEMPORARY BORING LOCATION (SEPT. 2010 & JAN. 2011)
- TEMPORARY BORING LOCATION ADVANCED < 16.5 FT. (JULY 2013)
- TEMPORARY BORING LOCATION ADVANCED ≥ 16.5 FT. (JULY 2013)
- TEMPORARY BORING LOCATION ADVANCED ≥ 16.5 FT. (OCT-NOV. 2013)
- TEMPORARY BORING LOCATION ADVANCED ≥ 16.5 FT. (DEC. 2013)
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL

TB22	SAMPLE ID
6/13/13	DATE SAMPLED
4-5	SAMPLE DEPTH/INTERVAL (FEET)
0.0046 U	TRICHLOROETHENE
0.0091 U	1,2-DICHLOROETHENE (TOTAL)
0.0044 U	VINYL CHLORIDE

NOTES

1.) ALL RESULTS ARE REPORTED IN MILLIGRAMS PER KILOGRAM (mg/Kg).

2.) U = INDICATES THAT THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE VALUE SHOWN IS THE METHOD DETECTION LIMIT (MDL).

3.) I = THE REPORTED VALUE IS BETWEEN THE LABORATORY MDL AND THE LABORATORY PRACTICAL QUANTITATION LIMIT.

4.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

120 0 120
APPROXIMATE SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
Pfizer
CAROLINA, PUERTO RICO

TITLE
SOIL ANALYTICAL RESULTS

Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746	FILE No.	10382746-R013
DESIGN	MCC	01/30/14	SCALE AS SHOWN	REV. 0
CADD	MRM	01/31/14		
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		

FIGURE 4

Drawing File: 10382746-R013.dwg May 15, 2014 - 10:06am

LEGEND

●	SHALLOW MONITORING WELL
▲	DEEP MONITORING WELL
33.31	GROUNDWATER ELEVATION
NM	NOT MEASURED
▬ ▬ ▬	GROUNDWATER CONTOUR INTERVAL (DASHED WHERE INFERRED)
⇨	ESTIMATED GROUNDWATER FLOW DIRECTION
*	ANOMALOUS DATA POINT (NOT USED FOR CONTOUR)

NOTES

1.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

120 0 120

APPROXIMATE SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

Pfizer
CAROLINA, PUERTO RICO

TITLE

POTENTIOMETRIC MAP OF THE SHALLOW ZONE GROUNDWATER - DECEMBER 2013 -

Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746	FILE No.	10382746-R002
DESIGN	MCC	01/24/14	SCALE AS SHOWN	REV. 0
CADD	BCL	01/24/14		
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		

FIGURE 5

Drawing File: 10382746-R002.dwg May 15, 2014 - 10:06am

MW-04S		
02/02/11	10/17/11	09/12/12
0.50 U	0.50 U	0.50 U
0.50 U	0.50 U	0.50 U
0.5	0.58 I	0.54 I
0.50 U	0.50 U	0.50 U
0.50 U	0.50 U	0.50 U
NM	NM	9.1
NM	NM	0.010 I
NM	NM	0.027 I

MW-05S			
02/02/11	10/17/11	09/12/12	12/5/13
0.50 U	0.50 U	0.50 U	0.50 U
1.8	2.4	2.1	3.7
1.7	0.74 I	1.1	1.2
0.5	0.59 I	0.74 I	0.79 I
0.50 U	0.50 U	0.50 U	0.50 U
NM	NM	2.6	1.9
NM	NM	0.070 I	0.018 U
NM	NM	0.064 I	0.022 I

MW-07S			
10/17/11	09/11/12	04/17/13	12/3/13
2.2	2.1	3.0	1.9
538	**467**	**375**	**703**
2.1	2.7	4.1	3.5
324	**309**	**403**	**494**
41.6	**77.2**	**70.8**	**99.2**
NM	0.20 U	NM	120
NM	0.20 U	NM	2.0
NM	0.20 U	NM	0.63

MW-15S
12/2/13
0.50 U
0.50 U
0.50 U
0.50 U
0.50 U
52
11
2.9

MW-11S
12/3/13
0.50 U
62.6
0.50 U
8.1
1.3
8.6
2.0
0.84

MW-02S				
02/02/11	10/18/11	09/11/12	04/17/13	12/4/13
1.4	1.6	1.4	1.5	1.3
1,630	**1,830**	**1,090**	**776**	**1,330**
9.9	**7.9**	**7.7**	**9.4**	**7.3**
1,490	**1,780**	**1,200**	**1,280**	**1,390**
303	**253**	**222**	**130**	**329**
NM	NM	410	NM	600
NM	NM	5.3	NM	0.87
NM	NM	4.3	NM	1.7

MW-06S			
02/02/11	10/18/11	09/11/12	12/5/13
0.50 U	0.50 U	0.50 U	0.50 U
19	**17.9**	**17.8**	**26.0**
7.4	5.9	5.0	6.3
4.1	4.4	3.5	4.4
0.50 U	0.50 U	0.50 U	0.50 U
NM	NM	3.0	3.3
NM	NM	0.017 I	0.018 U
NM	NM	0.052 I	0.030 I

MW-03S				
02/02/11	10/18/11	09/12/12	04/17/13	12/4/13
85.4	**133**	**110**	**68**	**132**
20	**34.3**	**30.0**	**37.9**	**36.8**
6.9	**7.5**	**7.5**	**9.8**	**7.2**
32.2	46.9	46.6	54.4	45.9
4.3	**4.1**	**4.2**	**3.5**	**6.3**
NM	NM	1.0	NM	0.46
NM	NM	0.19 I	NM	0.16 I
NM	NM	0.14 I	NM	0.045 I

MW-12S
12/2/13
28.3
109.0
2.9
44.0
1.6
4.2
0.49
0.53

MW-13S
12/2/13
3.5
3,510
12.1
2,610
429
550
14
13

MW-01S		
02/02/11	10/17/11	09/12/12
0.5	0.64 I	0.72 I
2.8	3.2	2.3
1.2	0.80 I	0.50 U
0.50 U	0.50 U	0.50 U
0.50 U	0.50 U	0.50 U
NM	NM	0.12 I
NM	NM	0.20 U
NM	NM	0.037 I

MW-09S		
10/17/11	09/11/12	12/4/13
0.50 U	0.50 U	0.50 U
14.3	**13.7**	**13.7**
9.2	**8.5**	**8.1**
0.99 I	0.76 I	0.85 I
0.50 U	0.50 U	0.50 U
NM	0.68	1.3
NM	0.20 U	0.018 U
NM	0.050 I	0.026 I

MW-10S
12/3/13
29.7
11.6
2.8
10.8
1.3
1.0
0.37
0.032 I

MW-08S		
10/17/11	09/12/12	12/5/13
25.9	**31.4**	**10.9**
12.1	**11.3**	4.3
2.3	2.4	0.85 I
10	10.7	2.9
2.1	0.50 U	0.50 U
NM	0.35	0.48
NM	0.059 I	0.018 U
NM	0.086 I	0.035 I

MW-14S
12/4/13
0.50 U
1.2
0.50 U
0.50 U
0.50 U
12.0
5.2
0.13 I

LEGEND

SHALLOW MONITORING WELL

DEEP MONITORING WELL

	MW-15S	MONITORING WELL ID
	12/2/13	SAMPLE DATE
MCLs	5	TETRACHLOROETHENE
	5	TRICHLOROETHENE
	7	1,1-DICHLOROETHENE
	70	cis-1,2-DICHLOROETHENE
	2	VINYL CHLORIDE
NO MCLs	NM	METHANE
	NM	ETHANE
	NM	ETHENE

NOTES

1.) ALL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (µg/L).

2.) SHADED CELL AND BOLD FONT INDICATE AN EXCEEDANCE OF AN APPLICABLE MCL.

3.) MCL = FEDERAL MAXIMUM CONTAMINANT LEVEL FROM http://water.epa.gov/drink/contaminants/index.cfm#List AS OF 10/11/10.

4.) U = INDICATES THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE VALUE SHOWN IS THE METHOD DETECTION LIMIT (MDL).

5.) I = THE REPORTED VALUE IS BETWEEN THE LABORATORY MDL AND THE LABORATORY PRACTICAL QUANTITATION LIMIT.

6.) NM = ANALYTE NOT MEASURED.

7.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

120 0 120

APPROXIMATE SCALE FEET

REV DATE DES REVISION DESCRIPTION CADD CHK RVW

PROJECT

Pfizer
CAROLINA, PUERTO RICO

TITLE

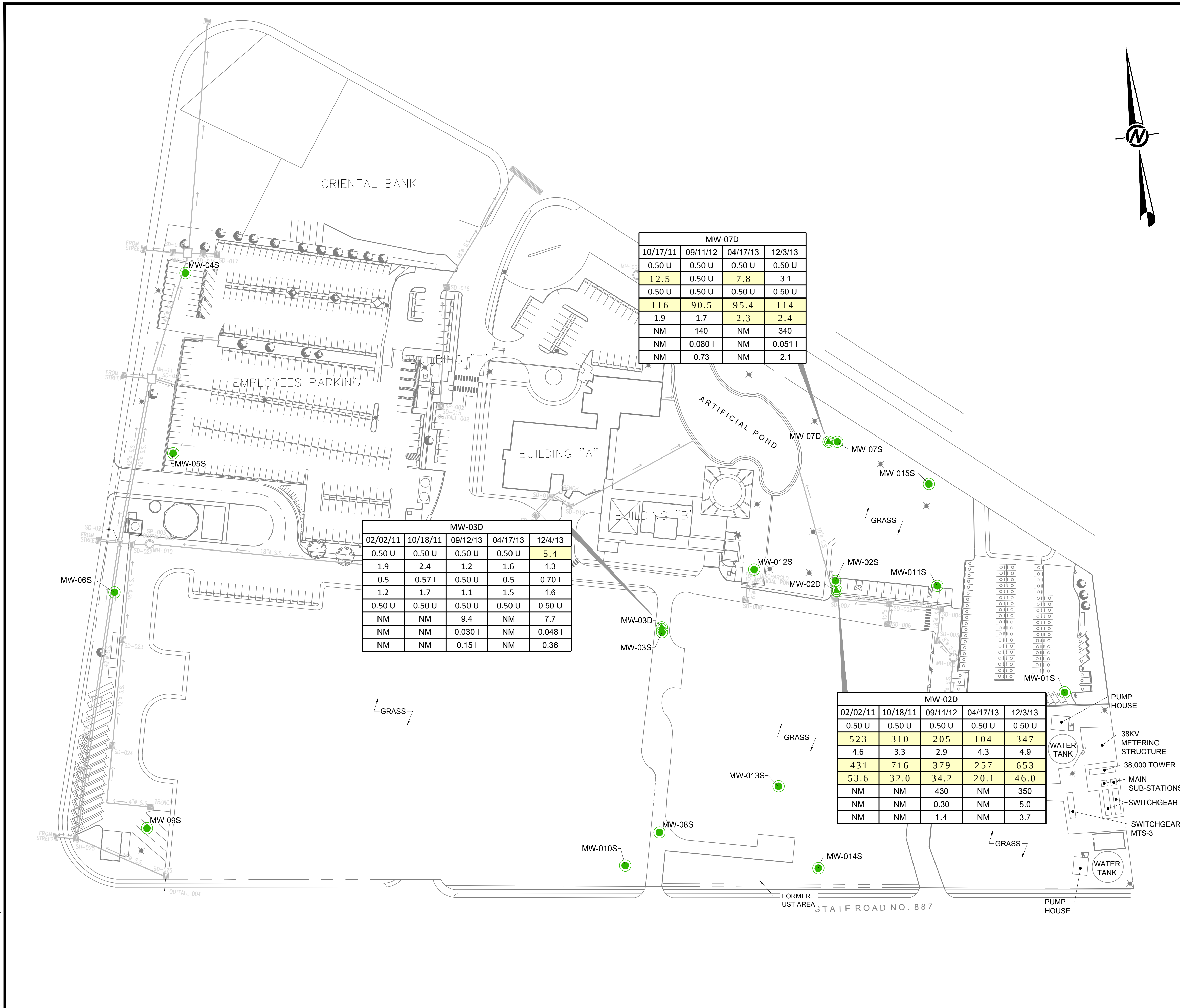
GROUNDWATER MONITORING IN THE SHALLOW ZONE - DECEMBER 2013 -

Golder Associates
Jacksonville, Florida

PROJECT No.	103-82746		FILE No.	10382746-R001
DESIGN	MCC	01/24/14	SCALE AS SHOWN	REV. 0
CADD	MRM	01/31/14		
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		

FIGURE 6

Drawing file: 10382746-R001.dwg May 15, 2014 - 10:05am



MW-07D			
10/17/11	09/11/12	04/17/13	12/3/13
0.50 U	0.50 U	0.50 U	0.50 U
12.5	0.50 U	**7.8**	3.1
0.50 U	0.50 U	0.50 U	0.50 U
116	**90.5**	**95.4**	**114**
1.9	1.7	**2.3**	**2.4**
NM	140	NM	340
NM	0.080 I	NM	0.051 I
NM	0.73	NM	2.1

MW-03D				
02/02/11	10/18/11	09/12/13	04/17/13	12/4/13
0.50 U	0.50 U	0.50 U	0.50 U	**5.4**
1.9	2.4	1.2	1.6	1.3
0.5	0.57 I	0.50 U	0.5	0.70 I
1.2	1.7	1.1	1.5	1.6
0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
NM	NM	9.4	NM	7.7
NM	NM	0.030 I	NM	0.048 I
NM	NM	0.15 I	NM	0.36

MW-02D				
02/02/11	10/18/11	09/11/12	04/17/13	12/3/13
0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
523	**310**	**205**	**104**	**347**
4.6	3.3	2.9	4.3	4.9
431	**716**	**379**	**257**	**653**
53.6	**32.0**	**34.2**	**20.1**	**46.0**
NM	NM	430	NM	350
NM	NM	0.30	NM	5.0
NM	NM	1.4	NM	3.7

LEGEND

SHALLOW MONITORING WELL

DEEP MONITORING WELL

	MW-15S	MONITORING WELL ID
	12/2/13	SAMPLE DATE
MCLs	5	TETRACHLOROETHENE
MCLs	5	TRICHLOROETHENE
MCLs	7	1,1-DICHLOROETHENE
MCLs	70	cis-1,2-DICHLOROETHENE
MCLs	2	VINYL CHLORIDE
NO MCLs	NM	METHANE
NO MCLs	NM	ETHANE
NO MCLs	NM	ETHENE

NOTES

1.) ALL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (µg/L).

2.) SHADED CELL AND BOLD FONT INDICATE AN EXCEEDANCE OF AN APPLICABLE MCL.

3.) MCL = FEDERAL MAXIMUM CONTAMINANT LEVEL FROM http://water.epa.gov/drink/contaminants/index.cfm#List AS OF 10/11/10.

4.) U = INDICATES THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE VALUE SHOWN IS THE METHOD DETECTION LIMIT (MDL).

5.) I = THE REPORTED VALUE IS BETWEEN THE LABORATORY MDL AND THE LABORATORY PRACTICAL QUANTITATION LIMIT.

6.) NM = ANALYTE NOT MEASURED.

7.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

120 0 120

APPROXIMATE SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

Pfizer
CAROLINA, PUERTO RICO

TITLE

GROUNDWATER MONITORING IN THE DEEPER ZONE - DECEMBER 2013 -

Golder Associates
Jacksonville, Florida

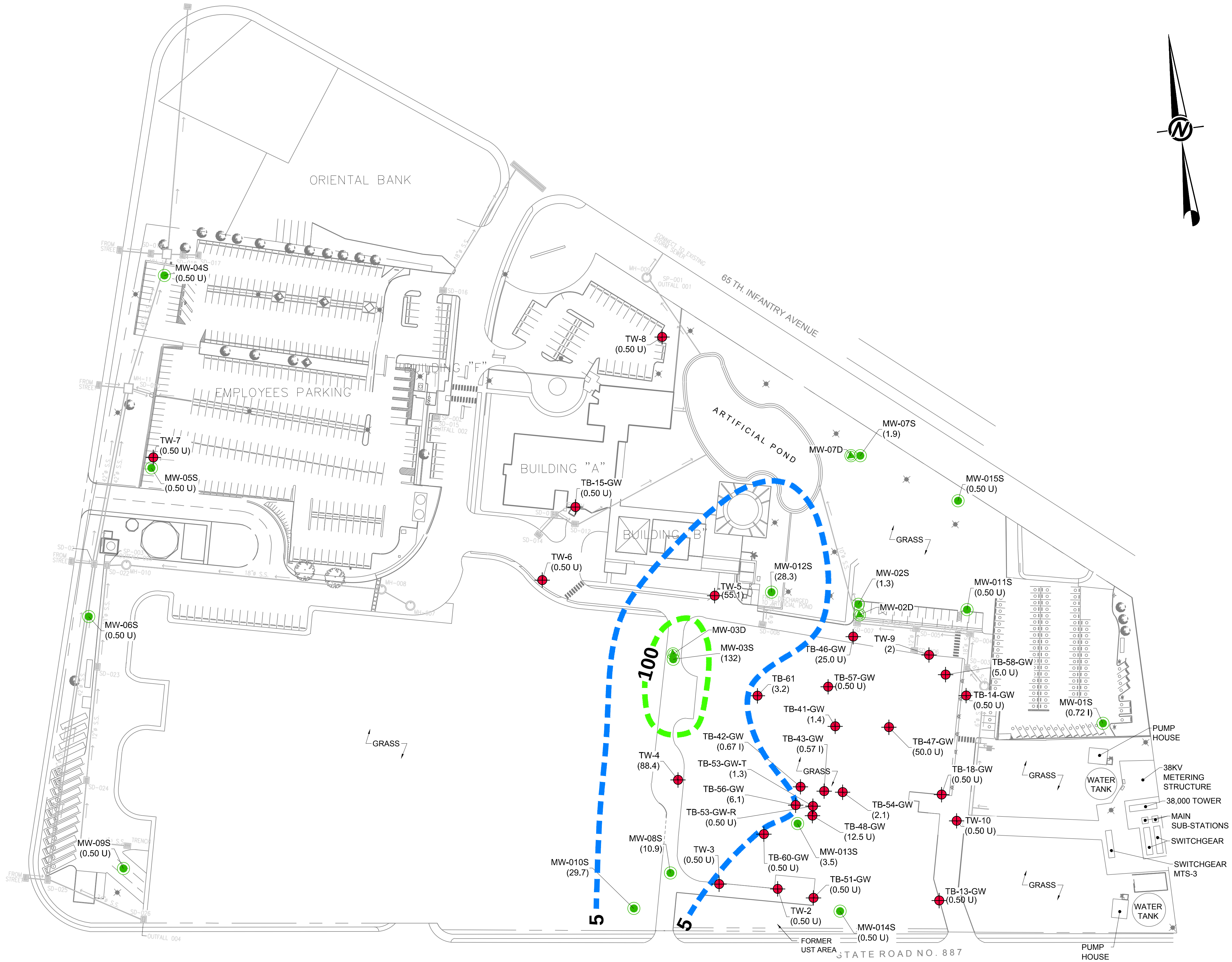
PROJECT No.		103-82746
DESIGN	MCC	01/24/14
CADD	MRM	01/31/14
CHECK	KAB	05/15/14
REVIEW	LAH	05/15/14

FILE No. 10382746-R001

SCALE AS SHOWN REV. 0

FIGURE 7

Drawing File: 10382746-R001.dwg May 15, 2014 - 10:04am



LEGEND

- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- TEMPORARY MONITORING WELL
- PCE CONCENTRATION CONTOUR - 5 ug/L
- PCE CONCENTRATION CONTOUR - 100 ug/L
- (132) PCE CONCENTRATION (ug/L)

NOTES

1.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

2.) PCE = TETRACHLOROETHENE.

3.) ug/L = MICROGRAMS PER LITER.

4.) U = INDICATES THAT THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE VALUE SHOWN IS THE METHOD DETECTION LIMIT.

5.) I = THE REPORTED VALUE IS BETWEEN THE LABORATORY METHOD DETECTION LIMIT AND THE LABORATORY PRACTICAL QUANTITATION LIMIT.

6.) MAXIMUM CONTAMINANT LEVEL (MCL) FOR PCE IS 5 ug/L.

7.) TW-2 THROUGH TW-10 RESULTS FROM SEPTEMBER 2010.

8.) TB-13-GW, TB-14-GW, AND TB-15-GW RESULTS FROM JANUARY 2011.

9.) MW-01S AND MW-04S RESULTS FROM SEPTEMBER 2012.

10.) TB-18-GW RESULTS FROM JUNE 2013.

11.) TB-41-GW, TB-42-GW, TB-43-GW, TB-46-GW, TB-47-GW, AND TB-48-GW RESULTS FROM JULY 2013.

12.) TB-51-GW, TB-53-GW-T, TB-53-GW-R, TB-54-GW, TB-56-GW, TB-57,GW, AND TB-58-GW RESULTS FROM OCTOBER 2013.

13.) TB-60-GW AND TB-61-GW RESULTS FROM DECEMBER 2013.

14.) ALL CONTOURS DASHED WHERE INFERRED.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

120 0 120
APPROXIMATE SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

Pfizer
CAROLINA, PUERTO RICO

TITLE

PCE ANALYTICAL RESULTS IN GROUNDWATER

Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746	FILE No.	10382746-R006
DESIGN	MCC	01/24/14	SCALE AS SHOWN	REV. 0
CADD	MRM	01/29/14		
CHECK	KAB	05/15/14	**FIGURE 8**	
REVIEW	LAH	05/15/14		

LEGEND

- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- TEMPORARY MONITORING WELL
- TCE CONCENTRATION CONTOUR - 5 ug/L
- TCE CONCENTRATION CONTOUR - 100 ug/L
- TCE CONCENTRATION CONTOUR - 1,000 ug/L
- (703) TCE CONCENTRATION (ug/L)

NOTES

1.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

2.) TCE = TRICHLOROETHENE.

3.) ug/L = MICROGRAMS PER LITER.

4.) U = INDICATES THAT THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE VALUE SHOWN IS THE METHOD DETECTION LIMIT.

5.) THE REPORTED VALUE IS BETWEEN THE LABORATORY METHOD DETECTION LIMIT AND THE LABORATORY PRACTICAL QUANTITATION LIMIT.

6.) MAXIMUM CONTAMINANT LEVEL (MCL) FOR TCE IS 5 ug/L.

7.) TW-2 THROUGH TW-10 RESULTS FROM SEPTEMBER 2010.

8.) TB-13-GW, TB-14-GW, AND TB-15-GW RESULTS FROM JANUARY 2011.

9.) MW-01S AND MW-04S RESULTS FROM SEPTEMBER 2012.

10.) TB-18-GW RESULTS FROM JUNE 2013.

11.) TB-41-GW, TB-42-GW, TB-43-GW, TB-46-GW, TB-47-GW, AND TB-48-GW RESULTS FROM JULY 2013.

12.) TB-51-GW, TB-53-GW-T, TB-53-GW-R, TB-54-GW, TB-56-GW, TB-57,GW, AND TB-58-GW RESULTS FROM OCTOBER 2013.

13.) TB-60-GW AND TB-61-GW RESULTS FROM DECEMBER 2013.

14.) ALL CONTOURS DASHED WHERE INFERRED.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

120 0 120
APPROXIMATE SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
Pfizer
CAROLINA, PUERTO RICO

TITLE
TCE ANALYTICAL RESULTS IN GROUNDWATER

Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746	FILE No.	10382746-R005
DESIGN	MCC	01/24/14	SCALE AS SHOWN	REV. 0
CADD	MRM	01/29/14		
CHECK	KAB	05/15/14	FIGURE 9	
REVIEW	LAH	05/15/14		

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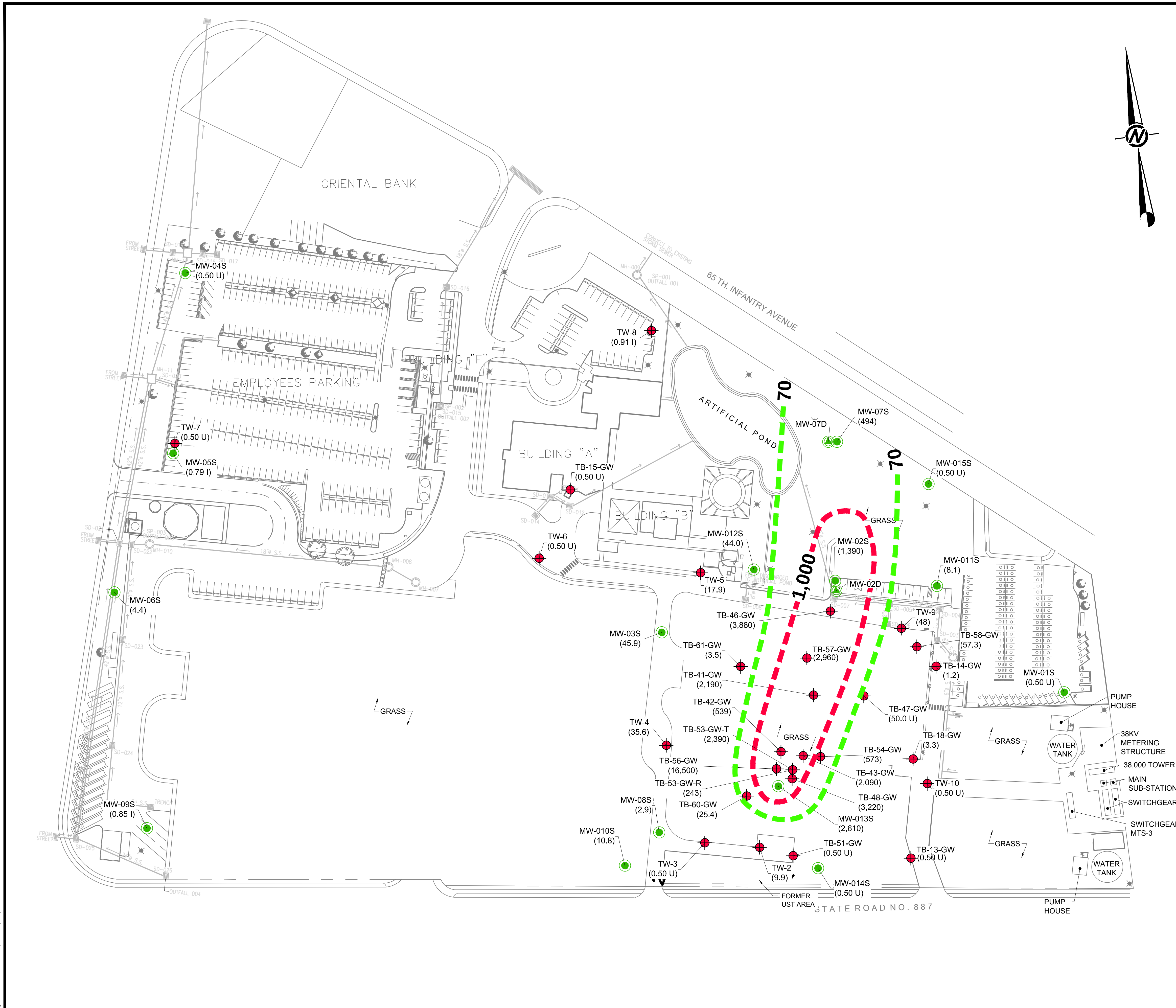


LEGEND

- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- TEMPORARY MONITORING WELL
- 1,2-DCE CONCENTRATION CONTOUR - 70 ug/L
- 1,2-DCE CONCENTRATION CONTOUR - 1,000 ug/L
- (17.9) 1,2-DCE CONCENTRATION (ug/L)

NOTES

1.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

2.) 1,2-DCE = 1,2-DICHLOROETHENE.

3.) ug/L = MICROGRAMS PER LITER.

4.) U = INDICATES THAT THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE VALUE SHOWN IS THE METHOD DETECTION LIMIT.

5.) I = THE REPORTED VALUE IS BETWEEN THE LABORATORY METHOD DETECTION LIMIT AND THE LABORATORY PRACTICAL QUANTITATION LIMIT.

6.) MAXIMUM CONTAMINANT LEVEL (MCL) FOR cis-1,2-DCE IS 70 ug/L.

7.) TW-2 THROUGH TW-10 RESULTS FROM SEPTEMBER 2010.

8.) TB-13-GW, TB-14-GW, AND TB-15-GW RESULTS FROM JANUARY 2011.

9.) MW-01S AND MW-04S RESULTS FROM SEPTEMBER 2012.

10.) TB-18-GW RESULTS FROM JUNE 2013.

11.) TB-41-GW, TB-42-GW, TB-43-GW, TB-46-GW, TB-47-GW, AND TB-48-GW RESULTS FROM JULY 2013

12.) TB-51-GW, TB-53-GW-T, TB-53-GW-R, TB-54-GW, TB-56-GW, TB-57,GW, AND TB-58-GW RESULTS FROM OCTOBER 2013.

13.) TB-60-GW AND TB-61-GW RESULTS FROM DECEMBER 2013.

14.) ALL CONTOURS DASHED WHERE INFERRED.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

120 0 120
APPROXIMATE SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

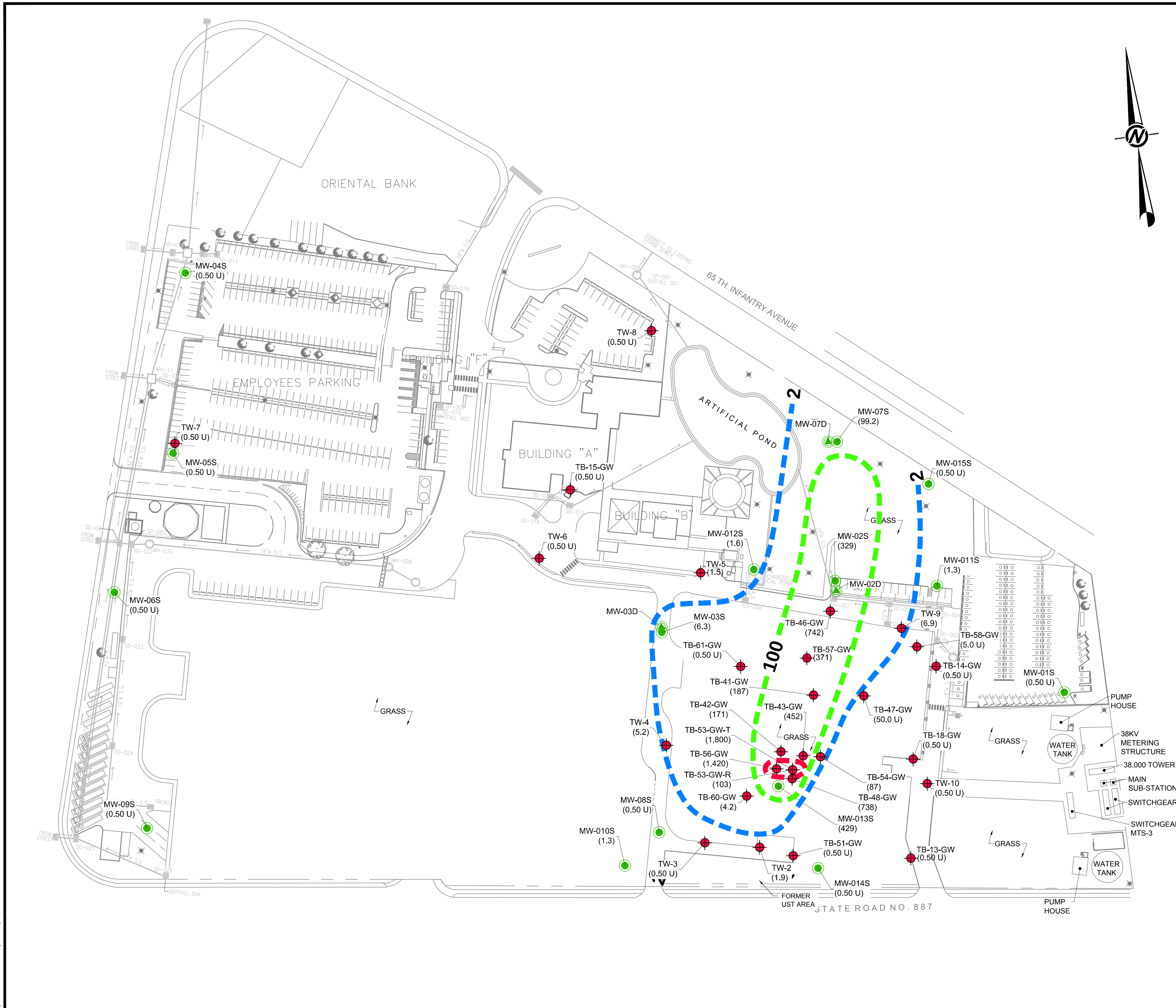
PROJECT
Pfizer
CAROLINA, PUERTO RICO

TITLE
1,2-DCE (TOTAL) ANALYTICAL RESULTS IN GROUNDWATER

Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746	FILE No.	10382746-R008
DESIGN	MCC	01/24/14	SCALE AS SHOWN	REV. 0
CADD	MRM	01/30/14	FIGURE 10	
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		

Drawing file: 10382746-R008.dwg May 15, 2014 - 10:02am



LEGEND

- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- TEMPORARY MONITORING WELL
- VC CONCENTRATION CONTOUR - 2 ug/L
- VC CONCENTRATION CONTOUR - 100 ug/L
- VC CONCENTRATION CONTOUR - 1,000 ug/L
- (1.3) VC CONCENTRATION (ug/L)

NOTES

1.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

2.) VC = VINYL CHLORIDE.

3.) ug/L = MICROGRAMS PER LITER.

4.) U = INDICATES THAT THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE VALUE SHOWN IS THE METHOD DETECTION LIMIT.

5.) MAXIMUM CONTAMINANT LEVEL (MCL) FOR VINYL CHLORIDE IS 2 ug/L.

6.) TW-2 THROUGH TW-10 RESULTS FROM SEPTEMBER 2010.

7.) TB-13-GW, TB-14-GW, AND TB-15-GW RESULTS FROM JANUARY 2011.

8.) MW-01S AND MW-04S RESULTS FROM SEPTEMBER 2012.

9.) TB-18-GW RESULTS FROM JUNE 2013.

10.) TB-41-GW, TB-42-GW, TB-43-GW, TB-46-GW, TB-47-GW, AND TB-48-GW RESULTS FROM JULY 2013.

11.) TB-51-GW, TB-53-GW-T, TB-53-GW-R, TB-54-GW, TB-56-GW, TB-57,GW, AND TB-58-GW RESULTS FROM OCTOBER 2013.

12.) TB-60-GW AND TB-61-GW RESULTS FROM DECEMBER 2013.

13.) ALL CONTOURS DASHED WHERE INFERRED.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

Pfizer
CAROLINA, PUERTO RICO

TITLE

VINYL CHLORIDE ANALYTICAL RESULTS IN GROUNDWATER

Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746	FILE No.	10382746-R007
DESIGN	MCC	01/24/14	SCALE AS SHOWN	REV. 0
CADD	MRM	01/30/14	FIGURE 11	
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		

Drawing file: 10382746-R007.dwg May 15, 2014 - 10:01am

LEGEND

- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- TEMPORARY MONITORING WELL

NOTES

1.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

Pfizer
CAROLINA, PUERTO RICO

TITLE

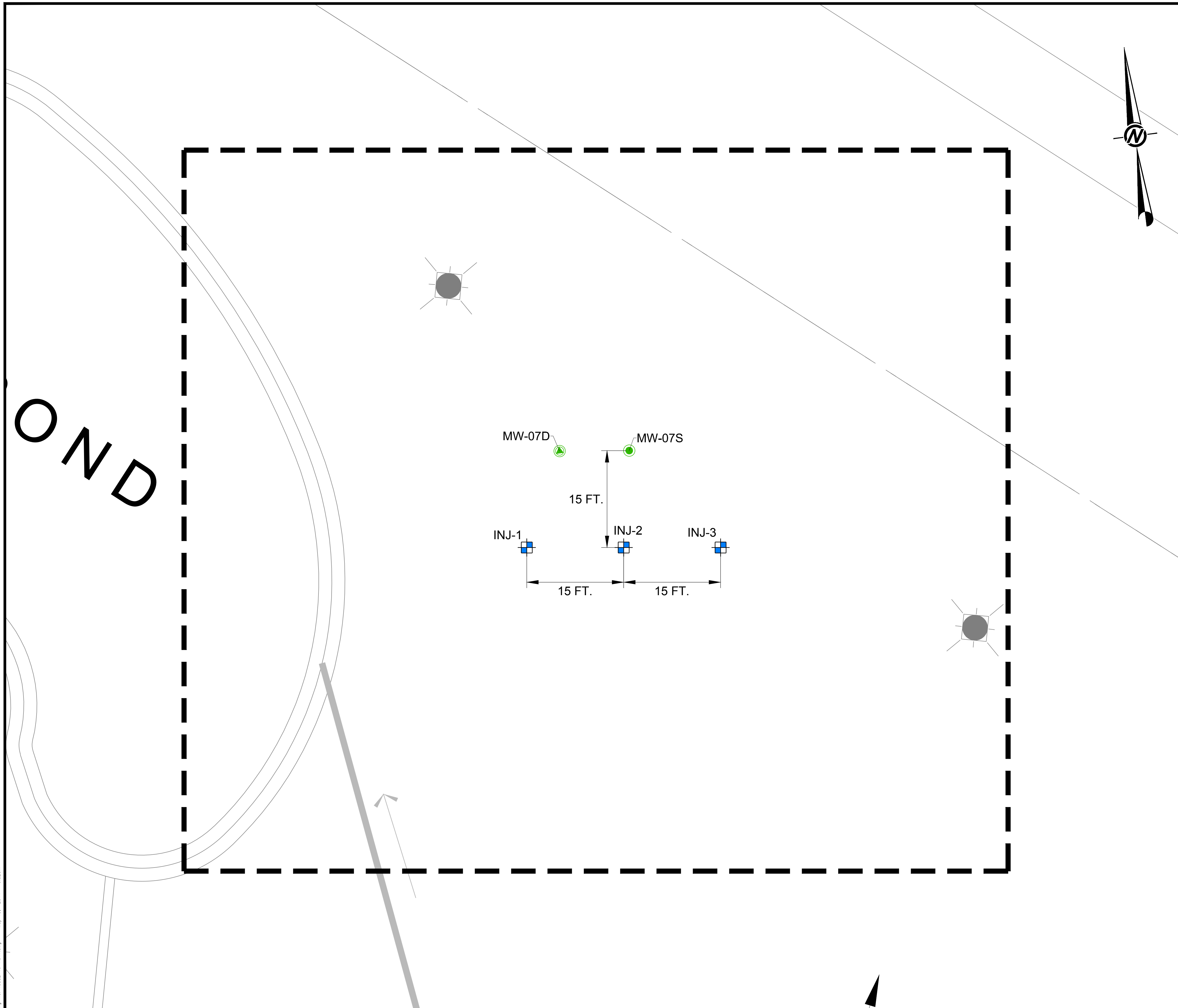
FIELD TEST TREATMENT AREAS

Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746	FILE No.	10382746-R016
DESIGN	MCC	02/05/14	SCALE AS SHOWN	REV. 0
CADD	MRM	02/06/14		
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		

FIGURE 12

Drawing file: 10382746-R016.dwg May 15, 2014 - 10:00am



LEGEND

- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- TEMPORARY MONITORING WELL
- PROPOSED BEDROCK INJECTION WELL

NOTES

1.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

15 0 15

APPROXIMATE SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

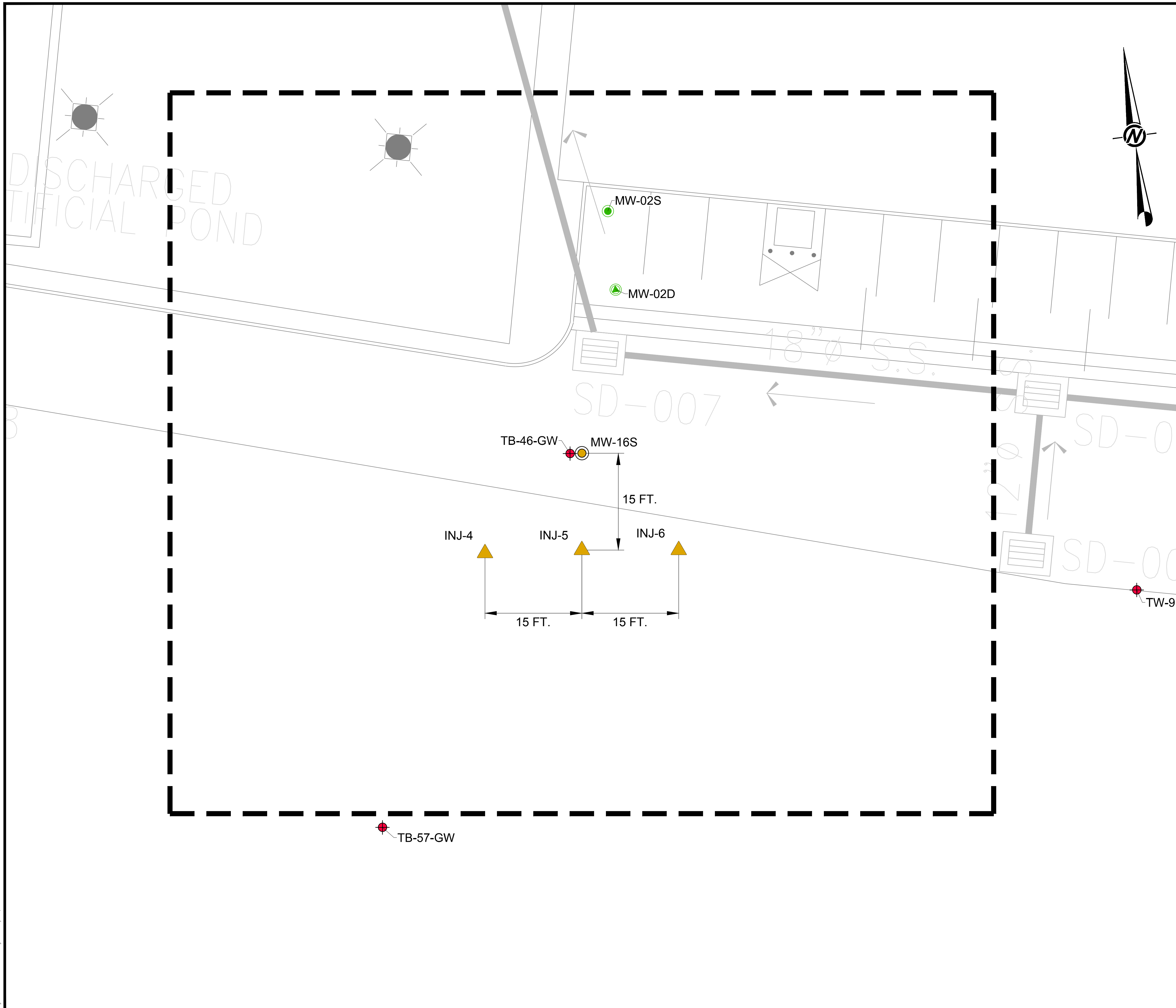
Pfizer
CAROLINA, PUERTO RICO

TITLE

FIELD TEST AREA A INJECTION WELL LOCATIONS

Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746	FILE No.	10382746-R017
DESIGN	MCC	02/12/14	SCALE AS SHOWN	REV. 0
CADD	MRM	02/12/14	**FIGURE 12A**	
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		



LEGEND

- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- TEMPORARY MONITORING WELL
- PROPOSED SHALLOW FIELD TEST (OVERBURDEN) INJECTION WELL
- PROPOSED NEW SHALLOW MONITORING WELL

NOTES

1.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

Pfizer
CAROLINA, PUERTO RICO

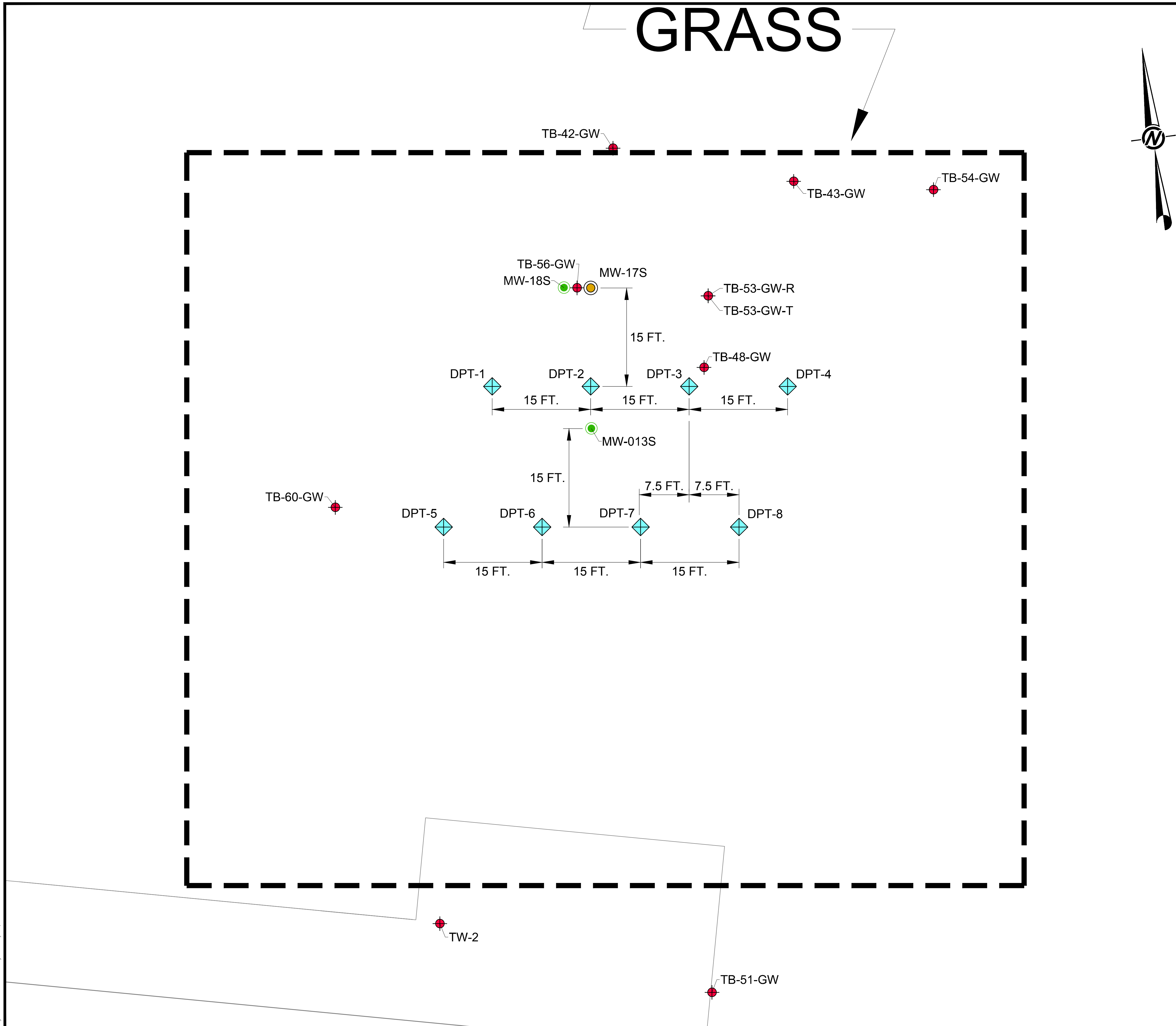
TITLE

FIELD TEST AREA B INJECTION WELL LOCATIONS

Golder Associates
Jacksonville, Florida

PROJECT No.	103-82746		FILE No.	10382746-R017
DESIGN	MCC	02/05/14	SCALE AS SHOWN	REV. 0
CADD	MRM	02/06/14		
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		

FIGURE 12B



LEGEND

- SHALLOW MONITORING WELL
- TEMPORARY MONITORING WELL
- PROPOSED FIELD TEST DPT INJECTION POINT
- PROPOSED NEW SHALLOW MOITORING WELL

NOTES

1.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

2.) DPT - DIRECT PUSH TECHNOLOGY.

3.) IF DPT IS UNABLE TO REACH THE TARGET INJECTION DEPTH, TEMPORARY OR PERMANENT INJECTION WELLS WILL BE INSTALLED USING A HOLLOW STEM AUGER OR AIR ROTARY DRILL RIG AT THE PROPOSED LOCATIONS OF DPT-1, DPT-2, DPT-3.

REFERENCES

1.) BASE MAP TAKEN FROM CADD FILE ORIGINALLY PREPARED BY WYETH - CAROLINA TITLED "STORM WATER PLAN", FILE NAME "C-SITE-004.dwg", REVISION 2, DATED 05/11/2010. BASE MAP MODIFIED BY GOLDER ASSOCIATES ON 02/06/2014 TO REFLECT EXISTING SITE CONDITIONS AS PER AERIAL PHOTOGRAPHS PROVIDED BY PFIZER INC., DATED 11/01/2013. ACTUAL SITE CONDITIONS MAY VARY.

15 0 15
APPROXIMATE SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
Pfizer
CAROLINA, PUERTO RICO

TITLE
FIELD TEST AREA C INJECTION WELL LOCATIONS

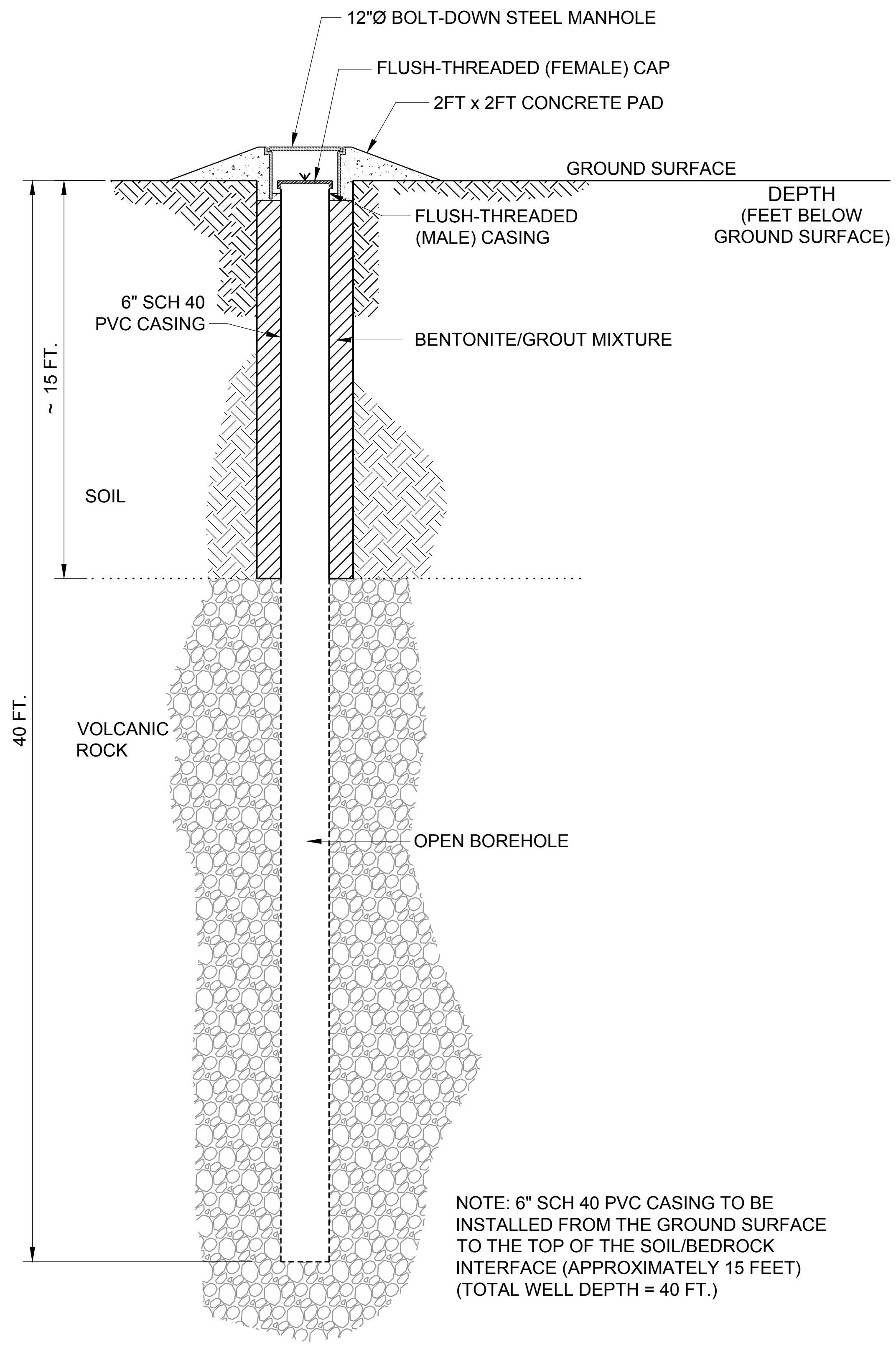
Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746
DESIGN	MCC	02/05/14
CADD	MRM	02/06/14
CHECK	KAB	05/15/14
REVIEW	LAH	05/15/14

FILE No. 10382746-R017
SCALE AS SHOWN REV. 0

FIGURE 12C

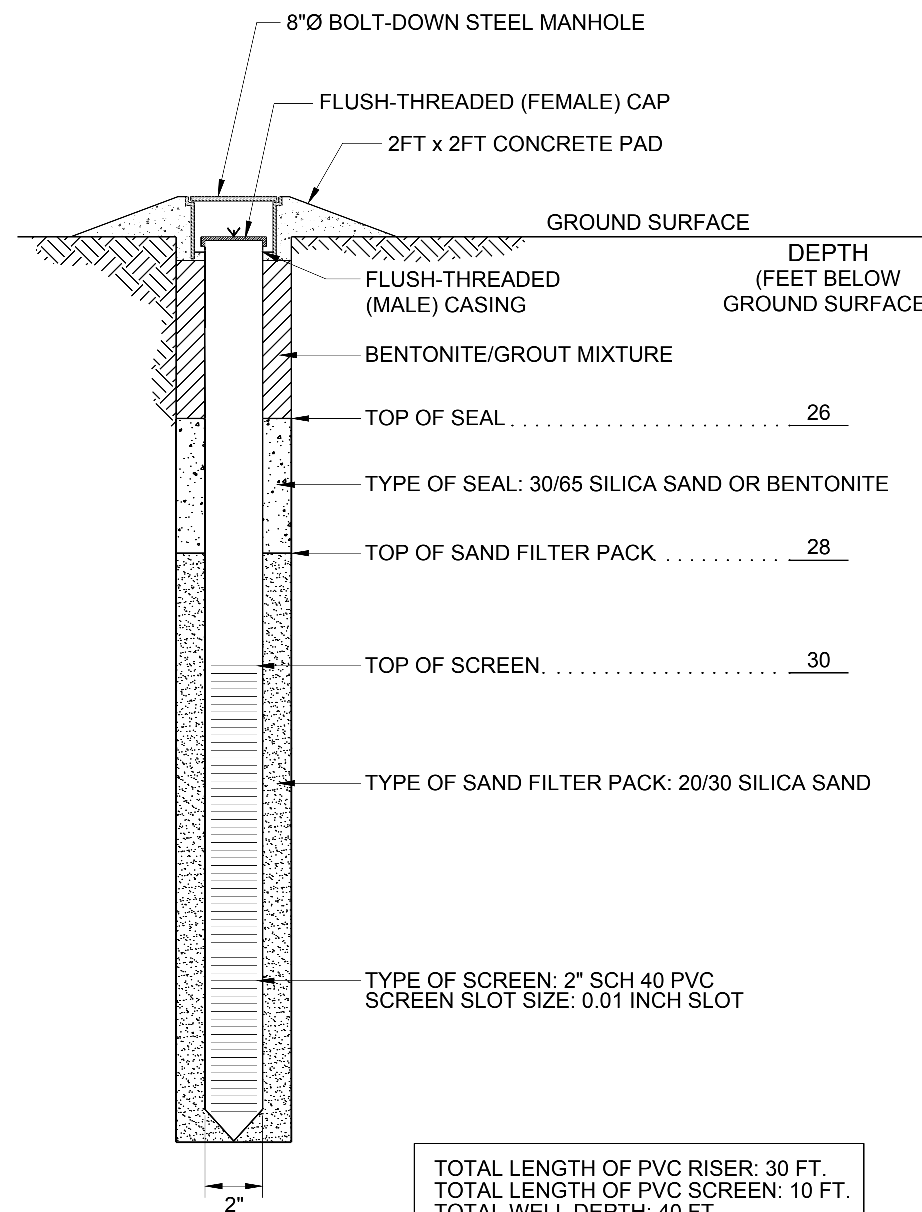
Drawing file: 10382746-R017.dwg May 15, 2014 - 9:51am



NOTE: 6" SCH 40 PVC CASING TO BE INSTALLED FROM THE GROUND SURFACE TO THE TOP OF THE SOIL/BEDROCK INTERFACE (APPROXIMATELY 15 FEET) (TOTAL WELL DEPTH = 40 FT.)

1 / 13 **BEDROCK INJECTION WELLS**

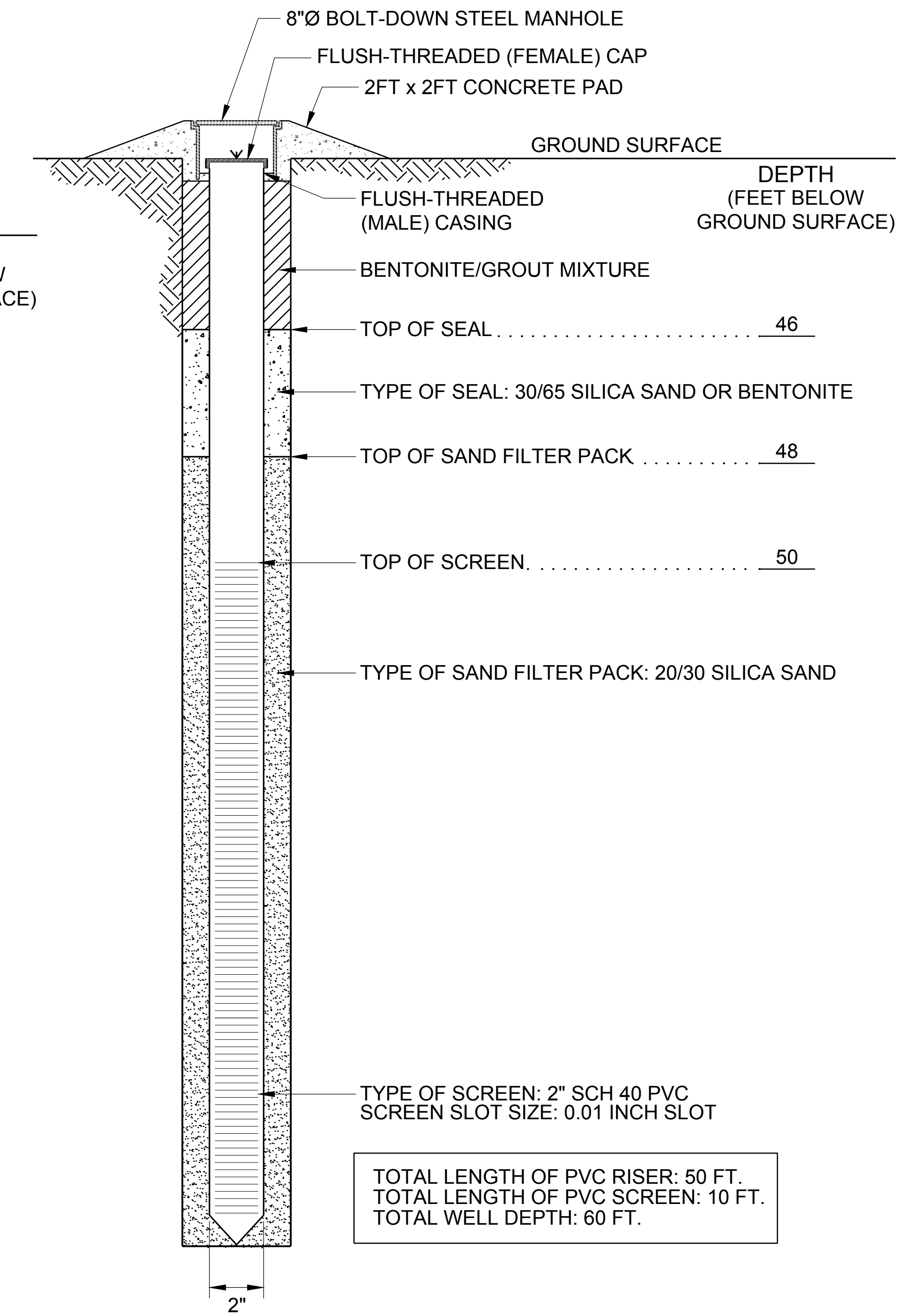
INJ-1, INJ-2, AND INJ-3



TOTAL LENGTH OF PVC RISER: 30 FT.
TOTAL LENGTH OF PVC SCREEN: 10 FT.
TOTAL WELL DEPTH: 40 FT.

2 / 13 **SHALLOW (OVERBURDEN) INJECTION WELLS AND NEW MONITORING WELLS**

INJ-4, INJ-5, INJ-6, MW-16S, AND MW-17S



TOTAL LENGTH OF PVC RISER: 50 FT.
TOTAL LENGTH OF PVC SCREEN: 10 FT.
TOTAL WELL DEPTH: 60 FT.

3 / 13 **NEW DEEPER (OVERBURDEN) MONITORING WELLS**

MW-18S

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

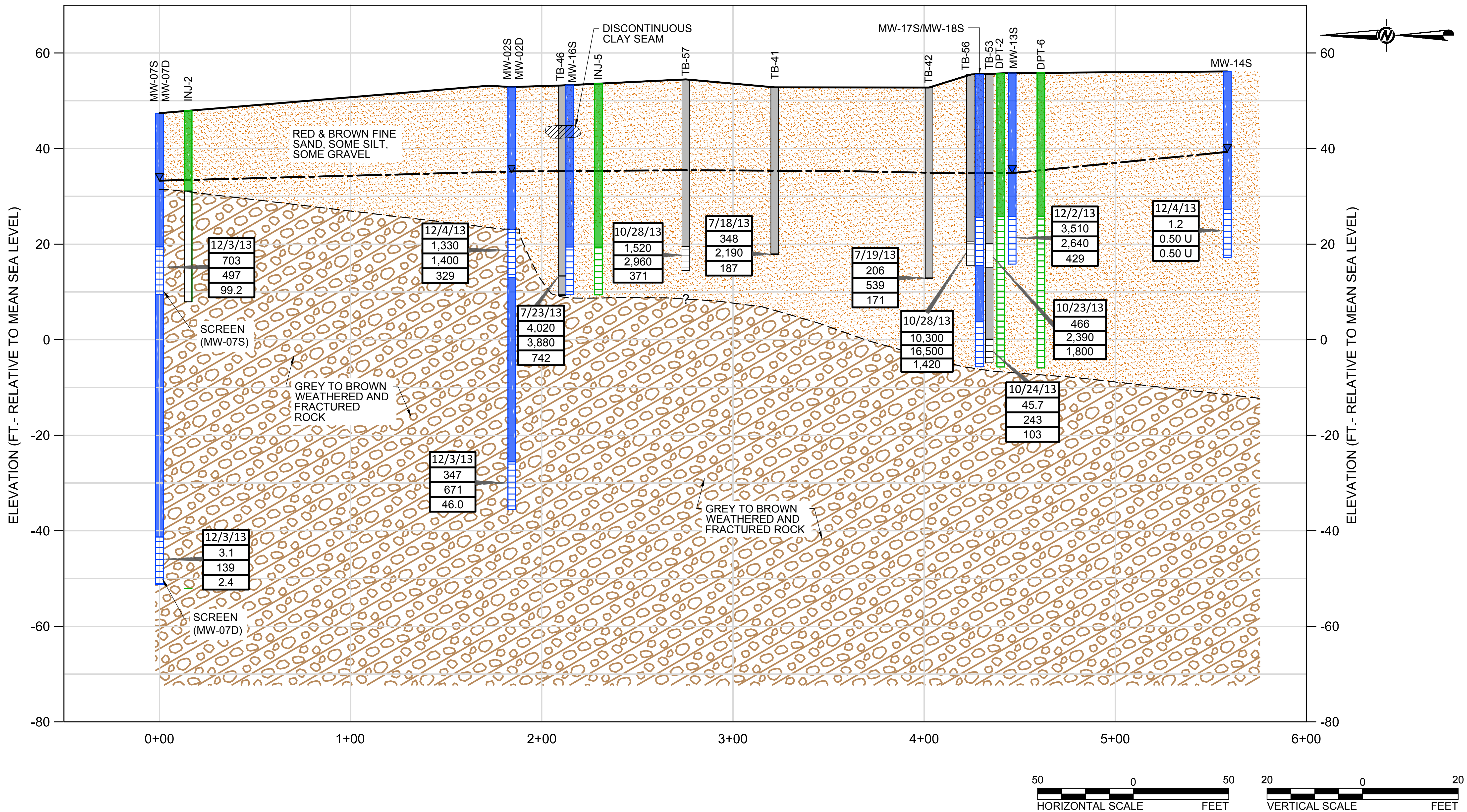
Pfizer
CAROLINA, PUERTO RICO

TITLE

FIELD TEST INJECTION WELL AND MONITORING WELL CONSTRUCTION DETAILS

Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746	FILE No.	10382746-R018
DESIGN	MCC	02/05/14	SCALE	N.T.S. REV. 0
CADD	MRM	02/06/14	**FIGURE 13**	
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		



LEGEND

FINE SAND	DASHED LINE WHERE CONTACT IS INFERRED
WEATHERED ROCK	? CONTACT NOT ENCOUNTERED IN BORING
CLAY	APPROXIMATE GROUNDWATER ELEVATION (DECEMBER 2013)
MEASURED GROUNDWATER ELEVATION	EXISTING OR PROPOSED MONITORING WELL LOCATION
	PROPOSED INJECTION LOCATION
	PREVIOUS TEMPORARY BORING LOCATION

NOTES

1.) ALL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (µg/L).

2.) MCL = FEDERAL MAXIMUM CONTAMINANT LEVEL FROM http://water.epa.gov/drink/contaminants/index.cfm#List AS OF 10/11/10.

3.) U = INDICATES THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE VALUE SHOWN IS THE METHOD DETECTION LIMIT (MDL).

4.) I = THE REPORTED VALUE IS BETWEEN THE LABORATORY MDL AND THE LABORATORY PRACTICAL QUANTITATION LIMIT.

5.) TEMPORARY BORING ELEVATIONS ARE APPROXIMATE.

12/4/13	SAMPLE DATE
5	TRICHLOROETHENE
70	cis-1,2-DICHLOROETHENE (TOTAL)
2	VINYL CHLORIDE

MCL

PROJECT

Pfizer
CAROLINA, PUERTO RICO

TITLE

FIELD TEST AREA CROSS-SECTION

Golder Associates

PROJECT No.		103-82746	FILE No.	10382746-R019
DESIGN	MCC	01/24/14	SCALE	AS SHOWN
CADD	BCL	01/24/14		
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		

FIGURE 14

N:\Files\2010\103-82746 Pfizer-Carolina Phase II\R - Remedial Action Plan\Active Drawings\10382746-R019.dwg | Layout: PILOT TEST AREA | Modified: Rmuise 05/15/2014 9:25 AM | Plotted: rmuise 05/15/2014 9:50 AM | Jacksonville, FL

APPENDIX A

PREVIOUS SITE PLAN AND BUILDING INFORMATION

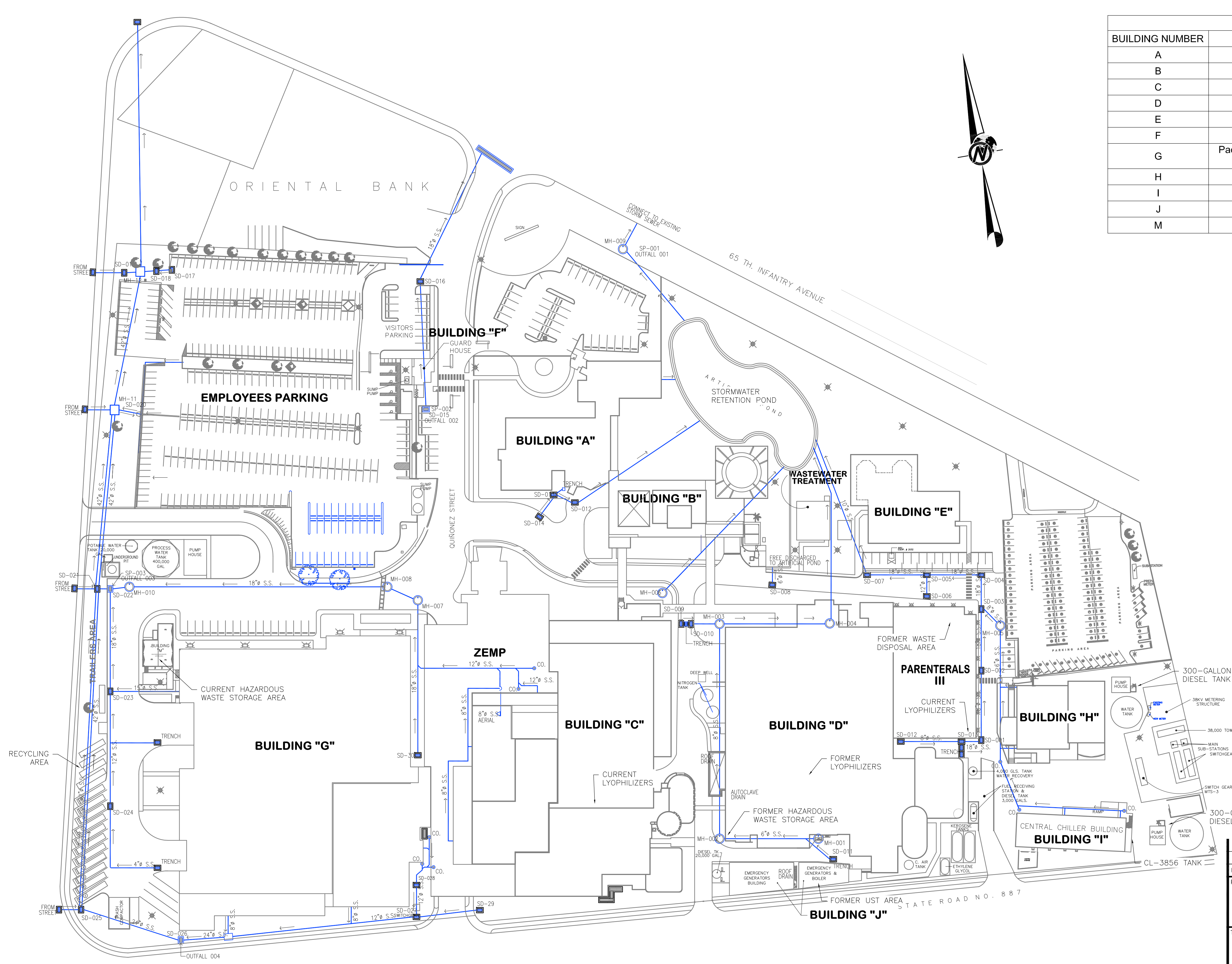
APPENDIX A
PREVIOUS BUILDING SUMMARY
PFIZER MANUFACTURING
CAROLINA, PUERTO RICO

Building Number	Year of Construction	Significant Renovations	Type of Construction	Use
A	As early as 1956 to 1957	Gym area was remodeled in 1985 and a second floor office area was remodeled in 1992.	Concrete block, Two-story First Floor - 14,046 ft^2 Second Floor - 3,872 ft^2	Human Resources, Learning Center, Purchasing, Materials Department
B	As early as 1956 to 1957		Concrete block, Single story First Floor - 11,077 ft^2	Cafeteria, Occupational Health and Wellness Department, Employee Center
C	As early as 1956 to 1957	Remodeled in 1979. An additional building expansion occurred in 2002.	Concrete block, Two-story First Floor - 64,440 ft^2 Second Floor - 55,695 ft^2 Expansion - 78,600 ft^2	Product Manufacturing
D	As early as 1956 to 1957	Series of remodeling from 1982 to 1985. Parenteral III extension to building was constructed in 2000.	Concrete block, Three-story First Floor - 80,653 ft^2 Second Floor - 75,233 ft^2 Third Floor - 12,754 ft^2	Antibiotic Product Manufacturing
E	1980		Concrete block, Single story First Floor - 8,519 ft^2	Administration
F	1986		Concrete block, Single story First Floor - 643 ft^2	Security Guard House
G	1990	Expanded in 1999.	Concrete block, Two-story First Floor - 82,811 ft^2 Second Floor - 31,577 ft^2	Packaging, ISD, Technical Services, SCI, Quality Assurance System and Stability, Materials Center, Customer Services.
H	1993		Concrete block, Two-story First Floor - 7,405 ft^2 Second Floor - 4,367 ft^2	Engineering and Maintenance Department
I	1998 or later		Concrete block, Two-story First Floor - 5,608 ft^2 Second Floor - 5,608 ft^2	Central Chiller Building

APPENDIX A
PREVIOUS BUILDING SUMMARY
PFIZER MANUFACTURING
CAROLINA, PUERTO RICO

Building Number	Year of Construction	Significant Renovations	Type of Construction	Use
J	2002		Concrete block, Two-story First Floor - 2,550 ft^2 Second Floor - 791 ft^2	Emergency Generators and Boilers Building
M	2006 or later		Concrete block, Single story	Hazardous Waste Storage, Stock Room Storage Area

Checked by: SDB
Reviewed by: MCC



BUILDING SUMMARY	
BUILDING NUMBER	USE
A	Human Resources, Training Offices, Purchasing, Materials Department
B	Cafeteria, Medical Department, Employee Center
C	Pharmaceutical Product Manufacturing
D	Pharmaceutical Product Manufacturing
E	Administration, Accounting Department, Quality Control Management
F	Security Guard House
G	Packaging, ISD, Technical Services, SCI, Quality Assurance System and Stability, Materials Center, Customer Services, Hazardous
H	Engineering and Maintenance Department
I	Central Chiller Building
J	Emergency Generator and Boiler Building
M	Hazardous Waste Storage

LEGEND

- STORM WATER LINE
- STORM DRAIN (SD)
- STORM WATER MANHOLE (MH)
- DRAIN FLOW

REFERENCES

1.) BASEMAP TAKEN FROM WYETH – CAROLINA, FILE NAME "C-SITE-004.dwg", TITLED "STORM WATER PLAN", DATED 08/18/2008.

PRIVILEGED AND CONFIDENTIAL

60 0 60
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
Pfizer
CAROLINA, PUERTO RICO

TITLE
SITE PLAN

Golder Associates
Jacksonville, Florida

PROJECT No.		103-86109	FILE No.	10386109-B002
DESIGN	SDB	08/30/10	SCALE AS SHOWN	REV. 0
CADD	MRM	09/01/10		
CHECK	SDB	11/11/10		
REVIEW	LAH	11/11/10		

FIGURE 2

Drawing file: 10386109B-002.dwg Nov 15, 2010 - 4:25pm

APPENDIX B

GEOLOGIC CROSS SECTIONS

LEGEND

- TEMPORARY BORING LOCATION (SEPT. 2010 & JAN. 2011)
- TEMPORARY BORING LOCATION ADVANCED < 16.5 FT. (JULY 2013)
- TEMPORARY BORING LOCATION ADVANCED ≥ 16.5 FT. (JULY 2013)
- TEMPORARY BORING LOCATION ADVANCED ≥ 16.5 FT. (OCT-NOV. 2013)
- TEMPORARY BORING LOCATION ADVANCED ≥ 16.5 FT. (DEC. 2013)
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- STORM WATER LINE
- STORM DRAIN (SD)
- STORM WATER MANHOLE (MH)
- DRAIN FLOW

NOTES

1.) ALL SITE BUILDINGS, WITH THE EXCEPTION OF BUILDINGS A, B, AND F, WERE DEMOLISHED IN 2013.

REFERENCES

1.) BASEMAP TAKEN FROM WYETH - CAROLINA, FILE NAME "C-SITE-004.dwg", TITLED "STORM WATER PLAN", DATED 08/18/2008.

120 0 120

APPROXIMATE SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

Pfizer
CAROLINA, PUERTO RICO

TITLE

CROSS SECTION LOCATION MAP

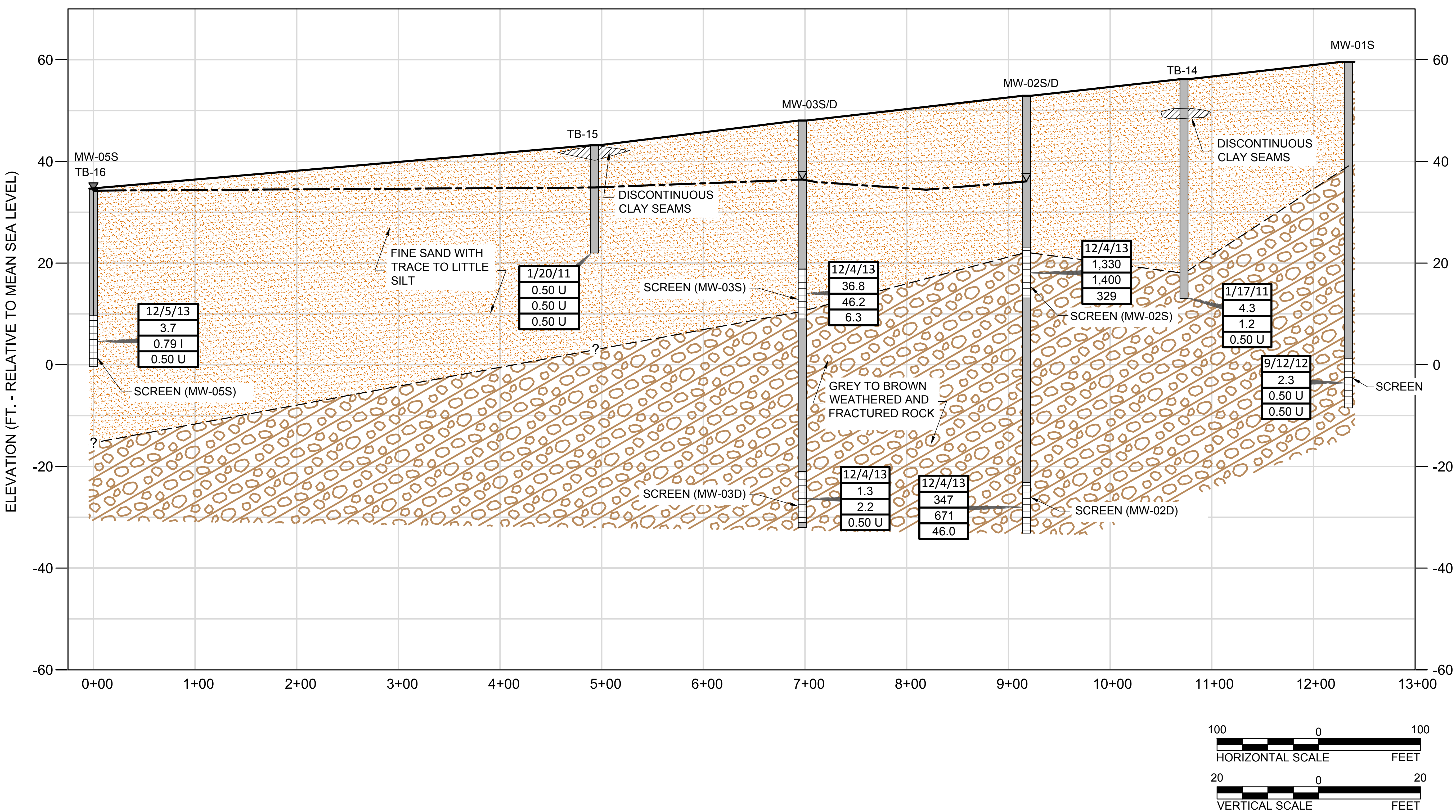
Golder Associates
Jacksonville, Florida

PROJECT No.		103-82746
DESIGN	MCC	01/24/14
CADD	BCL	01/24/14
CHECK	KAB	05/15/14
REVIEW	LAH	05/15/14

FILE No. 10382746-R003
SCALE AS SHOWN REV. 0

FIGURE B-1

Drawing File: 10382746-R003.dwg May 15, 2014 - 9:47am



LEGEND

FINE SAND

WEATHERED ROCK

CLAY

MEASURED GROUNDWATER ELEVATION

— — — — DASHED LINE WHERE CONTACT IS INFERRED

? CONTACT NOT ENCOUNTERED IN BORING

APPROXIMATE GROUNDWATER ELEVATION (DECEMBER 2013)

NOTES

1.) ALL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (µg/L).

2.) MCL = FEDERAL MAXIMUM CONTAMINANT LEVEL FROM http://water.epa.gov/drink/contaminants/index.cfm#List AS OF 10/11/10.

3.) U = INDICATES THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE VALUE SHOWN IS THE METHOD DETECTION LIMIT (MDL).

4.) I = THE REPORTED VALUE IS BETWEEN THE LABORATORY MDL AND THE LABORATORY PRACTICAL QUANTITATION LIMIT.

5.) TEMPORARY BORING ELEVATIONS ARE APPROXIMATE.

12/4/13	SAMPLE DATE
5	TRICHLOROETHENE
70	cis-1,2-DICHLOROETHENE (TOTAL)
2	VINYL CHLORIDE

MCL

PROJECT

Pfizer
CAROLINA, PUERTO RICO

TITLE

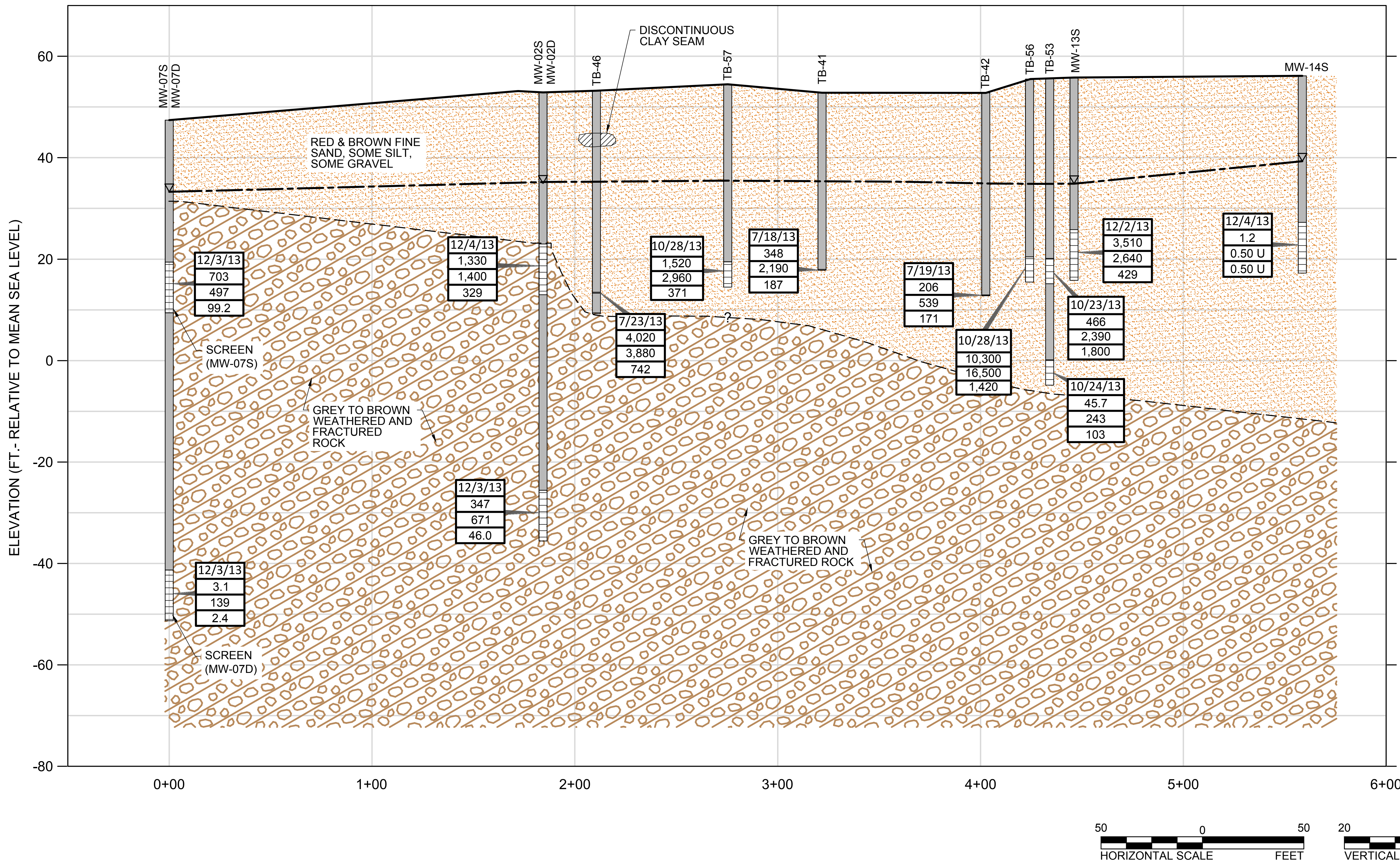
LITHOLOGIC CROSS-SECTION A-A'

Golder Associates

PROJECT No.		103-82746	FILE No.	10382746-R004
DESIGN	MCC	01/24/14	SCALE	AS SHOWN
CADD	BCL	01/24/14		
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		

FIGURE B-2

N:\File\2010\103-82746 Pfizer-Carolina Phase II\R - Remedial Action Plan\Active Drawings\10382746-R004.dwg | Layout: FIGURE 1A | Modified: Rmuise 05/15/2014 9:31 AM | Plotted: rmuise 05/15/2014 9:46 AM | Jacksonville, FL



N:\File\2010\103-82746 Pfizer-Carolina Phase II\R - Remedial Action Plan\Active Drawings\10382746-R004.dwg | Layout: FIGURE 1B | Modified: Rmuise 05/15/2014 9:31 AM | Plotted: rmuise 05/15/2014 9:45 AM | Jacksonville, FL

LEGEND

- FINE SAND
- WEATHERED ROCK
- CLAY
- ▽ MEASURED GROUNDWATER ELEVATION
- — — — DASHED LINE WHERE CONTACT IS INFERRED
- ? CONTACT NOT ENCOUNTERED IN BORING
- —— - —— APPROXIMATE GROUNDWATER ELEVATION (DECEMBER 2013)

NOTES

1.) ALL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (µg/L).

2.) MCL = FEDERAL MAXIMUM CONTAMINANT LEVEL FROM http://water.epa.gov/drink/contaminants/index.cfm#List AS OF 10/11/10.

3.) U = INDICATES THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE VALUE SHOWN IS THE METHOD DETECTION LIMIT (MDL).

4.) I = THE REPORTED VALUE IS BETWEEN THE LABORATORY MDL AND THE LABORATORY PRACTICAL QUANTITATION LIMIT.

5.) TEMPORARY BORING ELEVATIONS ARE APPROXIMATE.

12/4/13	SAMPLE DATE
5	TRICHLOROETHENE
70	cis-1,2-DICHLOROETHENE (TOTAL)
2	VINYL CHLORIDE

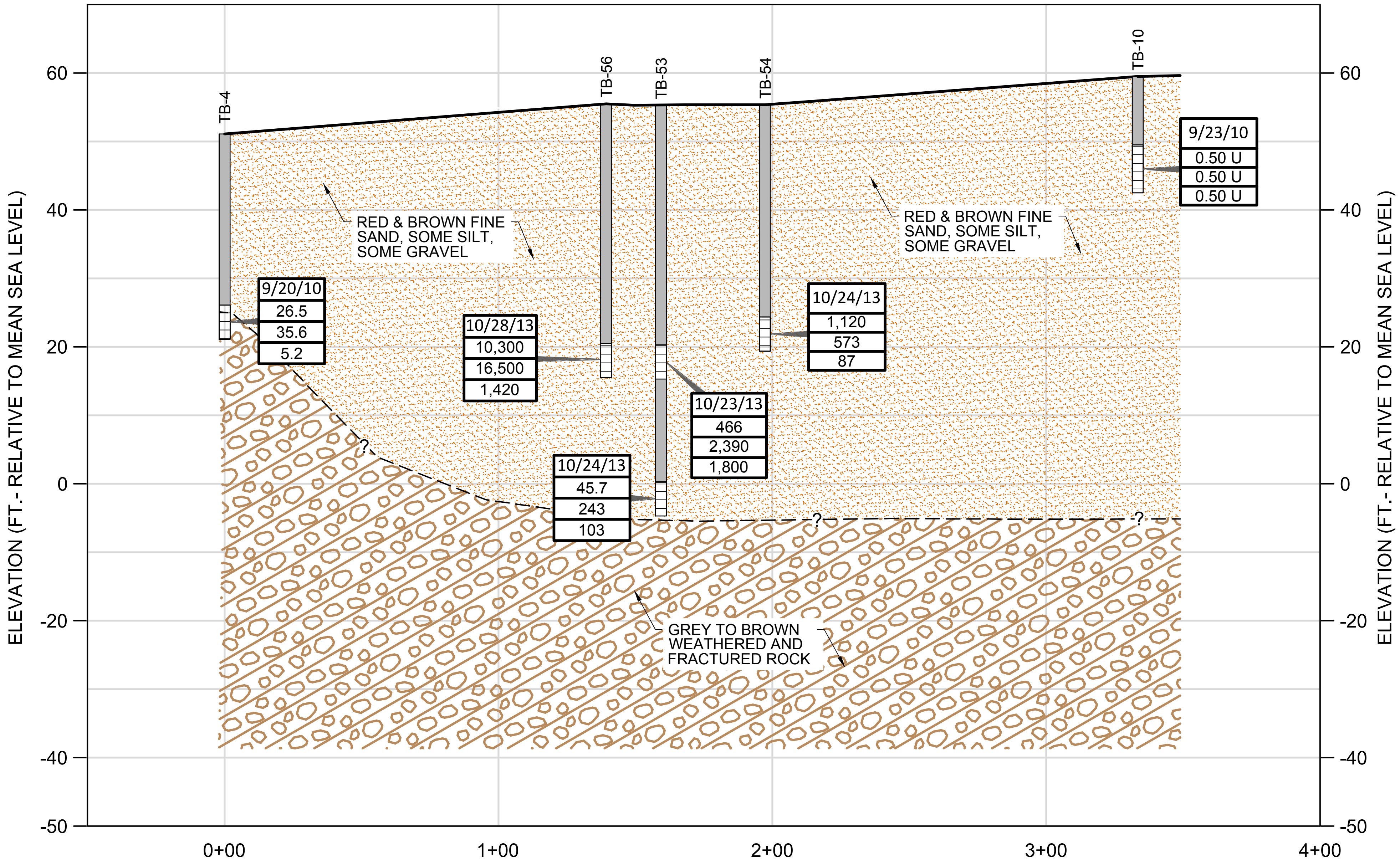
MCL

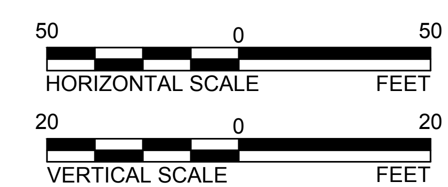
PROJECT
Pfizer
CAROLINA, PUERTO RICO

TITLE
LITHOLOGIC CROSS-SECTION B-B'

Golder Associates

PROJECT No.		103-82746	FILE No.	10382746-R004
DESIGN	MCC	01/24/14	SCALE	AS SHOWN
CADD	BCL	01/24/14		
CHECK	KAB	05/15/14	FIGURE B-3	
REVIEW	LAH	05/15/14		





LEGEND

- FINE SAND
- WEATHERED ROCK
- CLAY
- ▽ MEASURED GROUNDWATER ELEVATION
- — — — — DASHED LINE WHERE CONTACT IS INFERRED
- ? CONTACT NOT ENCOUNTERED IN BORING
- —— — —— APPROXIMATE GROUNDWATER ELEVATION (DECEMBER 2013)

NOTES

1.) ALL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (µg/L).

2.) MCL = FEDERAL MAXIMUM CONTAMINANT LEVEL FROM http://water.epa.gov/drink/contaminants/index.cfm#List AS OF 10/11/10.

3.) U = INDICATES THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE VALUE SHOWN IS THE METHOD DETECTION LIMIT (MDL).

4.) I = THE REPORTED VALUE IS BETWEEN THE LABORATORY MDL AND THE LABORATORY PRACTICAL QUANTITATION LIMIT.

5.) TEMPORARY BORING ELEVATIONS ARE APPROXIMATE.

12/4/13	SAMPLE DATE
5	TRICHLOROETHENE
70	cis-1,2-DICHLOROETHENE (TOTAL)
2	VINYL CHLORIDE

MCL

PROJECT
Pfizer
CAROLINA, PUERTO RICO

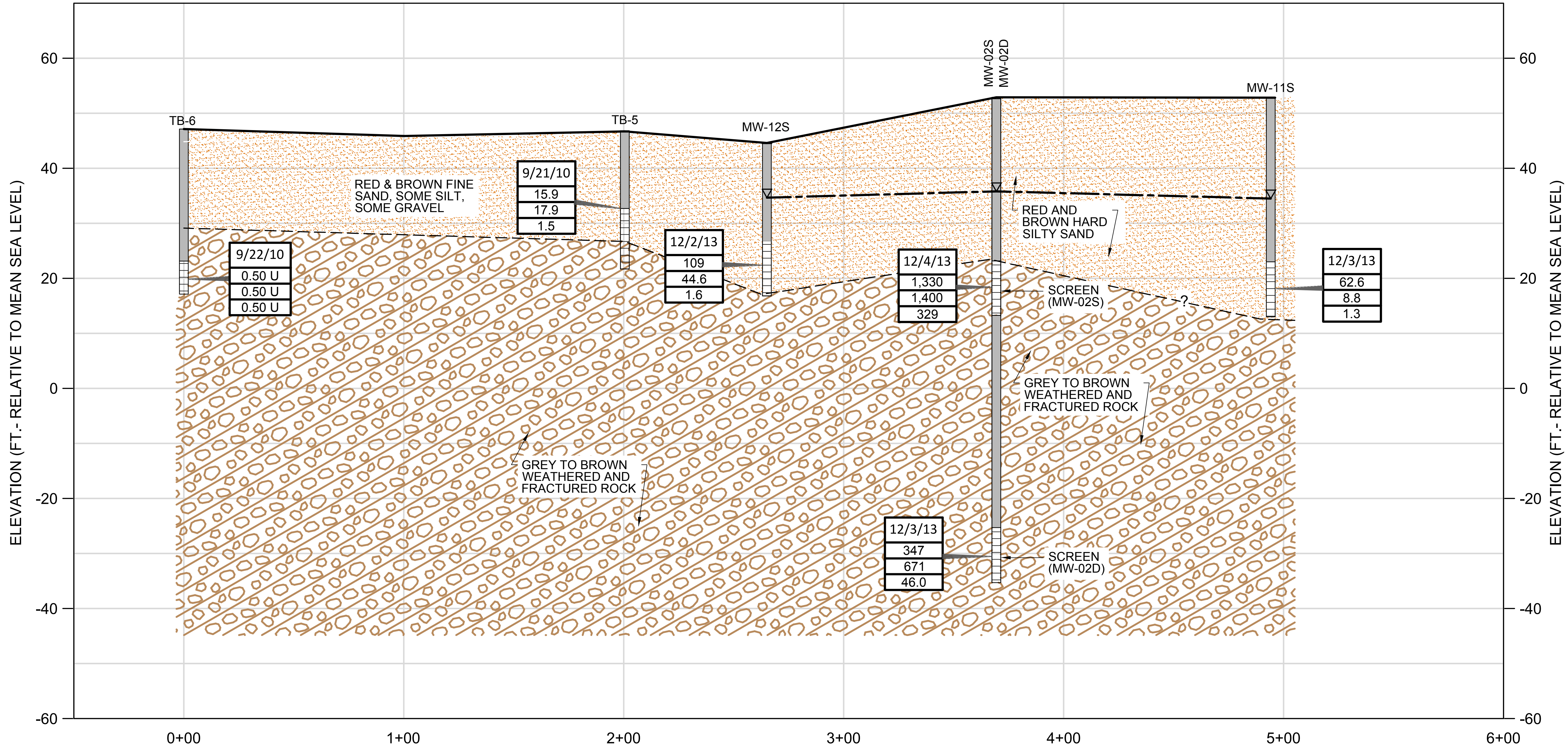
TITLE
LITHOLOGIC CROSS-SECTION C-C'

Golder Associates

PROJECT No.		103-82746	FILE No.	10382746-R004
DESIGN	MCC	01/24/14	SCALE	AS SHOWN
CADD	BCL	01/24/14		
CHECK	KAB	05/15/14		
REVIEW	LAH	05/15/14		

FIGURE B-4

N:\File\2010\103-82746 Pfizer-Carolina Phase II\R - Remedial Action Plan\Active Drawings\10382746-R004.dwg | Layout: FIGURE 1C | Modified: Rmuise 05/15/2014 9:31 AM | Plotted: rmuise 05/15/2014 9:45 AM | Jacksonville, FL



50 0 50
HORIZONTAL SCALE FEET

20 0 20
VERTICAL SCALE FEET

LEGEND

- FINE SAND
- WEATHERED ROCK
- CLAY
- MEASURED GROUNDWATER ELEVATION
- DASHED LINE WHERE CONTACT IS INFERRED
- ? CONTACT NOT ENCOUNTERED IN BORING
- APPROXIMATE GROUNDWATER ELEVATION (DECEMBER 2013)

NOTES

1.) ALL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (µg/L).

2.) MCL = FEDERAL MAXIMUM CONTAMINANT LEVEL FROM http://water.epa.gov/drink/contaminants/index.cfm#List AS OF 10/11/10.

3.) U = INDICATES THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE VALUE SHOWN IS THE METHOD DETECTION LIMIT (MDL).

4.) I = THE REPORTED VALUE IS BETWEEN THE LABORATORY MDL AND THE LABORATORY PRACTICAL QUANTITATION LIMIT.

5.) TEMPORARY BORING ELEVATIONS ARE APPROXIMATE.

12/4/13	SAMPLE DATE
5	TRICHLOROETHENE
70	cis-1,2-DICHLOROETHENE (TOTAL)
2	VINYL CHLORIDE

MCL

PROJECT
Pfizer
CAROLINA, PUERTO RICO

TITLE
LITHOLOGIC CROSS-SECTION D-D'

Golder Associates

PROJECT No.		103-82746	FILE No.	10382746-R004
DESIGN	MCC	01/24/14	SCALE	AS SHOWN
CADD	BCL	01/24/14		
CHECK	KAB	05/15/14	**FIGURE B-5**	
REVIEW	LAH	05/15/14		

APPENDIX C

CONTAMINANT MASS CALCULATIONS

Calculation Sheet

Estimated Soil Contaminant Mass - Vadose Zone

Project ID:	Pfizer - Carolina	Designed By: Matthew C. Crews
Project No:	103-82746.A	Checked By: Kirk Blevins
Date:	4/21/2014	

ASSUMPTIONS:

Estimated Surface Area of Soil Detections Above Laboratory MDLs =	9,800	square feet (CADD Estimate)
Impacted Overburden Treatment Thickness =	10	feet
Total Treatment Volume =	98,000	cubic feet
Soil Bulk Density =	87.4	pounds per cubic foot

			Concentrations (mg/kg)			
Sample ID	**Date Sampled**	**Depth (ft bgs)**	**PCE**	**TCE**	***cis*-1,2-DCE**	**VC**
EPA RSL (mg/kg)			**110**	**6.4**	**200**	**1.7**
TB-41	7/17/2013	20 - 22	0.0031	**0.0222**	**0.0691**	**0.0038**
TB-43	7/22/2013	32 - 34	0.0025	**0.5750**	**0.5550**	**0.0454**
TB-48	7/24/2013	24 - 26	0.0026	**0.0032**	0.0026	**0.0068**
TB-49	7/24/2013	22 - 24	0.0024	0.0027	**0.0034**	0.0026
TB-52	10/23/2013	20 - 22	0.0030	**1.15**	**0.0311**	0.0032
TB-52	10/23/2013	22 - 24	0.0031	**6.27**	**0.1720**	**0.0131**
TB-52	10/23/2013	24 - 26	0.0029	**1.63**	**0.0878**	**0.0035**
TB-54	10/24/2013	23	**0.0053**	**0.005**	**0.007**	**0.0062**
Average Concentration (µg/L)			0.0031	1.2073	0.1160	0.0106

	Constituents			
	PCE	**TCE**	***cis*-1,2-DCE**	**VC**
Estimated Vadose Zone Mass (grams)	12	4,700	452	41
Estimated Vadose Zone Mass (pounds)	0.03	10.36	1.00	0.09

Total VOCs (pounds)	**11.5**

Example Calculation: Estimated Vadose Zone Mass (grams)

TCE (grams) = (1.2073 mg/kg)(1 kg/2.2 lb)*(1 g/1,000 mg)*(87.4 lb/ft^3)*(98,000 ft^3) = 4,700 grams TCE*

Calculation Sheet

Estimated Groundwater Contaminant Mass - Saturated Overburden Material

Project ID: Pfizer - Carolina
Project No: 103-82746.A
Date: 4/21/2014

Designed By: Matthew C. Crews
Checked By: Kirk Blevins

ASSUMPTIONS:

Estimated Surface Area of Source Area MCL Exceedances =	190,000	square feet (CADD Estimate)
Impacted Overburden Treatment Thickness =	25	feet
Estimated Porosity =	0.25	
Soil Bulk Density =	87.4	pounds per cubic foot
Fraction Organic Carbon (f_{oc}) =	0.001	(silty sand)

Dissolved Phase Contaminant Volume =	1,187,500	cubic feet
Adsorbed Contaminant Volume =	3,562,500	cubic feet
Total Treatment Volume =	4,750,000	cubic feet

Organic Carbon Partition Coefficients (K_{oc}):

PCE	230	L/kg
TCE	87	L/kg
1,1- DCE	65	L/kg
cis -1,2-DCE	49	L/kg
VC	30	L/kg

			Concentrations (µg/L)				
Sample ID	**Date Sampled**	**Depth (ft bgs)**	**PCE**	**TCE**	**1,1-DCE**	***cis*-1,2-DCE**	**VC**
EPA MCL (µg/L)			**5**	**5**	**7**	**70**	**2**
MW-3S	12/4/2013	35	**132**	**36.8**	**7.2**	45.9	**6.3**
MW-10S	12/3/2013	35	**29.7**	**11.6**	2.8	10.8	1.3
MW-11S	12/3/2013	35	0.50	**62.6**	0.50	8.1	1.3
MW-12S	12/2/2013	35	**28.3**	**109**	2.9	44	1.6
MW-13S	12/2/2013	35	3.5	**3,510**	**12.1**	**2,610**	**429**
TB-41-GW	7/18/2013	35	1.4	**348**	**10.1**	**1,960**	**187**
TB-42-GW	7/19/2013	40	0.67	**206**	5.3	**530**	**171**
TB-43-GW	7/22/2013	33	0.57	**1,350**	**39.7**	**2,000**	**452**
TB-46-GW	7/23/2013	37.5	25	**4,020**	**25**	**3,860**	**742**
TB-48-GW	7/24/2013	40	12.5	**1,930**	**27.2**	**3,160**	**738**
TB-53-GW-T	10/23/2013	37.5	1.3	**466**	**16.5**	**2,330**	**1,800**
TB-54-GW	10/24/2013	33.5	2.1	**1120**	2.7	**568**	**87**
TB-56-GW	10/28/2013	37.5	**6.1**	**10,300**	**47.5**	**16,500**	**1,760**
TB-57-GW	10/28/2013	37.5	**0.5**	**1,520**	2.7	**2,950**	**371**
TB-58-GW	10/28/2013	37.5	5.0	**301**	5.0	50.7	**5.0**
TB-60-GW	12/8/2013	35	0.50	**71**	0.50	24	**4.2**
TB-61-GW	12/8/2013	37.5	3.2	**19.7**	0.50	3.5	0.50
Average Concentration (µg/L)			15	1,493	12	2,156	397

	Constituents				
	PCE	**TCE**	**1,1-DCE**	***cis*-1,2-DCE**	**VC**
Estimated Dissolved Phase Mass (grams)	500	50,211	412	72,512	13,367
Estimated Adsorbed Phase Mass (grams)	484	18,384	113	14,953	1,688
Total (grams)	984	68,595	525	87,465	15,055
Total (pounds)	2.2	151.2	1.2	192.8	33.2

Total VOCs (pounds)	**380.6**

Example Calculation: Estimated Dissolved Phase Mass (grams)

TCE (grams) = (1,493 µg/L)(1 mg/1,000 µg)*(1 g/1,000 mg)*(28.32 L/ft^3)*(1,187,500 ft^3) = 50,211 grams TCE*

Example Calculation: Estimated Adsorbed Phase Mass (grams)

TCE (grams) = (1,493 µg/L)(1 mg/1,000 µg)*(1 g/1,000 mg)*(87 L/kg)*(0.001)*(1 kg/2.2 lbs)*(87.4 lb/ft3)*(4,750,000 ft^3) = 18,384 grams TCE*

Calculation Sheet

Estimated Groundwater Contaminant Mass - Saturated Rock Material

Project ID: Pfizer - Carolina
Project No: 103-82746.A
Date: 4/21/2014

Designed By: Matthew C. Crews
Checked By: Kirk Blevins

ASSUMPTIONS:

Estimated Surface Area of Source Area MCL Exceedances = 190,000 square feet (CADD Estimate)
Impacted Overburden Treatment Thickness = 25 feet
Estimated Porosity = 0.6
Soil Bulk Density = 171.7 pounds per cubic foot
Fraction Organic Carbon (f_{oc}) = 0.0001 (rock)

Dissolved Phase Contaminant Volume = 2,850,000 cubic feet
Adsorbed Contaminant Volume = 1,900,000 cubic feet
Total Treatment Volume = 4,750,000 cubic feet

Organic Carbon Partition Coefficients (K_{oc}):

PCE	230	L/kg
TCE	87	L/kg
1,1- DCE	65	L/kg
cis -1,2-DCE	49	L/kg
VC	30	L/kg

Sample ID	Date Sampled	Depth (ft bgs)	Concentrations (µg/L) PCE	TCE	1,1-DCE	*cis-* 1,2-DCE	VC
EPA MCL (µg/L)			**5**	**5**	**7**	**70**	**2**
MW-02S	12/4/2013	35	1.3	**1,330**	**7.3**	**1,390**	**329**
MW-02D	12/3/2013	35	0.50	**347**	4.9	**653**	**46**
MW-03D	12/4/2013	35	**5.4**	1.3	0.70	1.6	0.50
MW-07S	12/3/2013	35	1.9	**703**	3.5	**494**	**99.2**
Average Concentration (µg/L)			2.3	595	4.1	635	119

	Constituents PCE	TCE	1,1-DCE	*cis-* 1,2-DCE	VC
Estimated Dissolved Phase Mass (grams)	184	48,050	331	51,224	9,578
Estimated Adsorbed Phase Mass (grams)	7.8	768	4.0	461	53
Total (grams)	191	48,818	335	51,685	9,631
Total (pounds)	0.4	107.6	0.7	113.9	21.2

Total VOCs (pounds) 244.0

Example Calculation: Estimated Dissolved Phase Mass (grams)

TCE (grams) = (595 µg/L)(1 mg/1,000 µg)*(1 g/1,000 mg)*(28.32 L/ft^3)*(2,850,000 ft^3) = 48,050 grams TCE*

Example Calculation: Estimated Adsorbed Phase Mass (grams)

TCE (grams) = (595 µg/L)(1 mg/1,000 µg)*(1 g/1,000 mg)*(87 L/kg)*(0.0001)*(1 kg/2.2 lbs)*(171.7 lb/ft3)*(1,900,000 ft^3) = 768 grams TCE*

APPENDIX D

HYDROGEOLOGIC CHARACTERIZATION DATA

TABLE 2
SUMMARY OF HYDRAULIC CONDUCTIVITY TEST RESULTS

September 2012
Pfizer, Carolina Facility, Puerto Rico

Well ID	Date Test Performed	Total Depth (ft-btoc)	Screen Interval (ft-btoc)	Analytical Method	Rising or Falling Head	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)
Shallow Surficial Aquifer							
MW-2S-1	9/20/2012	40.0	29.9-39.9	Bouwer & Rice	Falling	5.45E-03	15.5
MW-2S-1	9/20/2012	40.0	29.9-39.9	Bouwer & Rice	Rising	5.77E-03	16.4
MW-2S-2	9/20/2012	40.0	29.9-39.9	Bouwer & Rice	Falling	5.77E-03	16.4
MW-2S-2	9/20/2012	40.0	29.9-39.9	Bouwer & Rice	Rising	7.51E-03	21.3
Average MW-2S						**6.13E-03**	**17.4**
MW-3S-1	9/20/2012	40.0	29.9-39.9	Bouwer & Rice	Falling	2.92E-03	8.3
MW-3S-1	9/20/2012	40.0	29.9-39.9	Bouwer & Rice	Rising	2.13E-03	6.0
MW-3S-2	9/20/2012	40.0	29.9-39.9	Bouwer & Rice	Falling	2.42E-03	6.9
MW-3S-2	9/20/2012	40.0	29.9-39.9	Bouwer & Rice	Rising	2.08E-03	5.9
Average MW-3S						**2.39E-03**	**6.8**
				Geometric Mean (Unit S)		**3.82E-03**	**10.8**
Deeper Surficial Aquifer							
MW-2D-1	9/20/2012	88.0	77.2-87.2	Bouwer & Rice	Falling	5.25E-03	14.9
MW-2D-1	9/20/2012	88.0	77.2-87.2	Bouwer & Rice	Rising	5.72E-03	16.2
MW-2D-2	9/20/2012	88.0	77.2-87.2	Bouwer & Rice	Falling	5.31E-03	15.0
MW-2D-2	9/20/2012	88.0	77.2-87.2	Bouwer & Rice	Rising	5.58E-03	15.8
Average MW-2D						**5.46E-03**	**15.5**
MW-3D-1	9/20/2012	80.0	69.0-79.0	Bouwer & Rice	Falling	2.25E-03	6.4
MW-3D-1	9/20/2012	80.0	69.0-79.0	Bouwer & Rice	Rising	2.16E-03	6.1
MW-3D-2	9/20/2012	80.0	69.0-79.0	Bouwer & Rice	Falling	2.32E-03	6.6
MW-3D-2	9/20/2012	80.0	69.0-79.0	Bouwer & Rice	Rising	2.25E-03	6.4

TABLE 2
SUMMARY OF HYDRAULIC CONDUCTIVITY TEST RESULTS

September 2012
Pfizer, Carolina Facility, Puerto Rico

Well ID	Date Test Performed	Total Depth (ft-btoc)	Screen Interval (ft-btoc)	Analytical Method	Rising or Falling Head	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)
Average MW-3D						**2.25E-03**	**6.4**
MW-7D-1	9/20/2012	100.0	88.0-98.0	Bouwer & Rice	Falling	1.14E-03	3.2
MW-7D-1	9/20/2012	100.0	88.0-98.0	Bouwer & Rice	Rising	1.09E-03	3.1
MW-7D-2	9/20/2012	100.0	88.0-98.0	Bouwer & Rice	Falling	1.56E-03	4.4
MW-7D-2	9/20/2012	100.0	88.0-98.0	Bouwer & Rice	Rising	1.10E-03	3.1
Average MW-7D						**1.22E-03**	**3.5**
				Geometric Mean (Unit D)		**2.47E-03**	**6.7**

Notes:
cm/sec = centimeters per second ft bgs = feet below ground surface ft/day = feet per day
-1 = Test Run #1 -2 = Test Run #2
Test results averaged. Geometric mean taken for the average of each well for each of shallow and deeper interval.

Prepared by: RWP
Checked by: JJE
Reviewed by: LAH

SUBJECT Groundwater Flow Direction + Horizontal Hydraulic Gradient			
Job No. 103-82746A	**Made by** A. Marquez	**Date** 2/10/14
Ref.	**Checked** RFA 2/11/14	**Sheet** 1 of 2
	Reviewed NCC 2/11/14	

Golder Associates

PURPOSE: TO DETERMINE THE DIRECTION OF GROUNDWATER FLOW AND CALCULATE HORIZONTAL HYDRAULIC GRADIENTS FOR THE UPPER (pg. 1) AND DEEP (pg. 2) ZONES OF THE SURFICIAL AQUIFER AT THE PFIZER CAROLINA SITE.

GW. FLOW DIRECTION EQN.: $AD = AC\left(\frac{\Delta WL\ A-B}{\Delta WL\ A-C}\right)$

HORIZONTAL HYDRAULIC GRADIENT: $i = \frac{\Delta WL\ B-C}{\overline{CE}}$

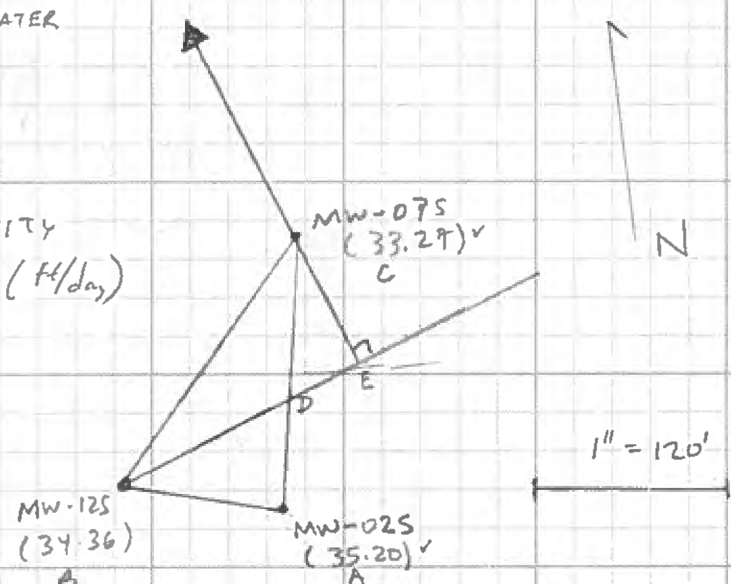
WHERE:

AD = DISTANCE (ft.) BETWEEN POINT A AND THE EQUIPOTENTIAL LINE (D)
AC = DISTANCE (ft) BETWEEN POINT A AND C
$\overline{CE}$ = DISTANCE (ft) BETWEEN POINT C AND THE PERPENDICULAR INTERSECT OF D
i = HYDRAULIC GRADIENT (DIMENSIONLESS)

AVERAGE LINEAR GROUNDWATER VELOCITY: $v = \frac{-Ki}{\eta}$

WHERE:

η = EFFECTIVE POROSITY
K = hydraulic conductivity (ft/day)



$\overline{AD} = \overline{AC}\left(\frac{\Delta WL\ A-B}{\Delta WL\ A-C}\right)$

$AD = 170\ FT\left(\frac{35.20 - 34.36}{35.20 - 33.27}\right)$

AD = 74 FT

$i = \frac{WL\ B-C}{\overline{CE}} = \frac{34.36 - 33.27}{90}$

$i = 0.012\ \frac{FT}{FT}$

$v = \frac{Ki}{\eta}$

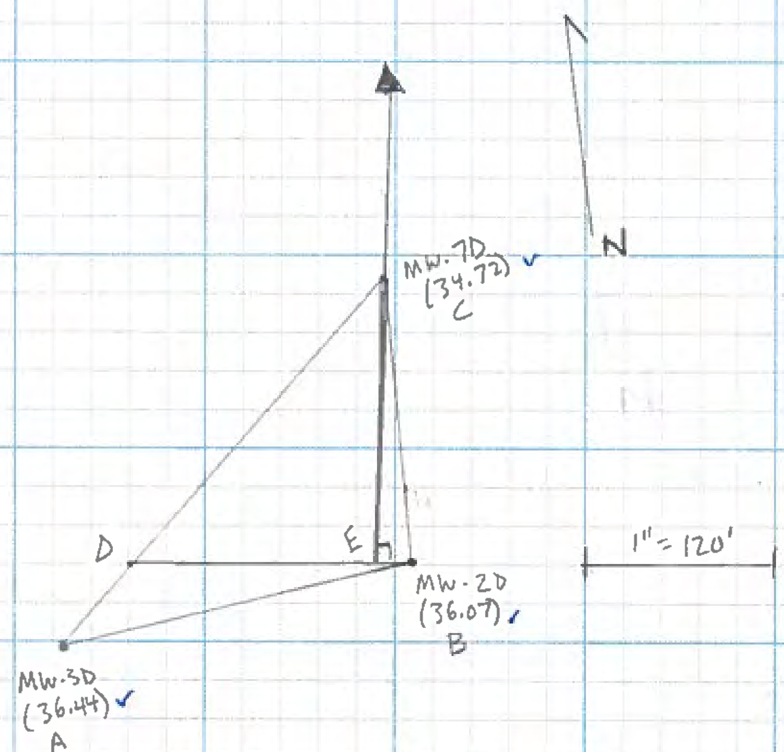
η = 25% (Fetter, 1994)

$v = \frac{(10.8\ ft/d)(0.012\ ft/ft)}{0.25}$

v = 0.518 ft/day
= 189 ft/year

GW FLOW: NORTH 21° WEST

HORIZONTAL HYDRAULIC CONDUCTIVITY (CONTINUED)
DEEP ZONE OF THE SURFICIAL AQUIFER
USING EQUATIONS AND DEFINITIONS FROM SHEET 1 OF 2



$$\overline{AD} = \overline{AC}\left(\frac{\Delta WL\ A-B}{\Delta WL\ A-C}\right)$$

$$AD = 306\left(\frac{36.44-36.07}{36.44-34.72}\right)$$

$AD = 66$ FT

$$i = \frac{\Delta WL\ B-C}{\overline{CE}} = \frac{36.07-34.72}{176}$$

$i = 0.008$ FT/FT

GW Flow = NORTH 9° EAST

$$V = \frac{Ki}{n}$$

$$V = \frac{(6.7\ ft/day)(0.008\ ft/ft)}{0.60} = 0.089\ ft/day$$

$= 32.6$ ft/year

$n = 60\%$ (Fetter, 1994)

Golder Associates	SUBJECT Vertical Gradient Calculation		
	Job No. 103-82746	Made by KAS	Date 11-14-11
	Ref. Pfizer- Carolina	Checked JLR Reviewed LAH	Sheet 1 of 1

CALCULATE THE VERTICAL GRADIENT BETWEEN SHALLOW/DEEPER WELLS AT THE MW-02S/D MW-03S/D, AND MW-07S/D CLUSTERS.

METHOD: ΔGW ELEVATION / Δ ELEVATION OF SCREEN CENTER = i

KNOWN:

WELL ID	GW ELEV (FT)	SCREEN CENTER ELEV (FT)
MW-02S	34.03	18.26
MW-02D	35.28	-29.31
MW-03S	35.33	13.12
MW-03D	35.61	-25.94
MW-07S	33.40	22.04
MW-07D	35.26	-44.70

$i_v = \frac{\Delta h}{\Delta l}$, WHERE h = GW ELEVATION
l = DISTANCE BTWN SCREEN CENTERS

MW-02S/D

$$i_v = \frac{34.03 - 35.28}{18.26 - (-29.31)} = \frac{-1.25}{47.57} = -0.026 = -2.6 \times 10^{-2}$$

MW-03S/D

$$i_v = \frac{35.33 - 35.61}{13.12 - (-25.94)} = \frac{-0.28}{39.06} = -0.0072 = -7.2 \times 10^{-3}$$

MW-07S/D

$$i_v = \frac{33.40 - 35.26}{22.04 - (-44.70)} = \frac{-1.86}{66.74} = -0.028 = -2.8 \times 10^{-2}$$

Golder Associates

SUBJECT Vertical Gradient Calculation		
Job No. 103-82746	Made by KAB	Date 10-10-12
Ref. Pfizer - Carolina	Checked RwP	Sheet of
	Reviewed	

Calculate the vertical gradient between shallow/deeper wells at the MW-02 S/D MW-03 S/D and MW-07 S/D clusters.

Method: Δ GW Elevations / Δ Elevation of screen center = i_v

Known:

Well ID	GW Elev (ft)	Screen Center Elev (ft)
MW-02S	33.17	18.26
MW-02D	34.43	-29.31
MW-03S	34.81	13.12
MW-03D	35.12	-25.94
MW-07S	32.64	22.04
MW-07D	34.42	-44.70

$i_v = \frac{\Delta h}{\Delta l}$, where h = GW Elevations
l = Distance btwn. screen centers

MW-02 S/D

$$i_v = \frac{33.17 - 34.43}{18.26 - (-29.31)} = \frac{-1.26}{47.57} = -0.026 = -2.6 \times 10^{-2}$$

MW-03 S/D

$$i_v = \frac{34.81 - 35.12}{13.12 - (-25.94)} = \frac{-0.31}{39.06} = -0.0079 = -7.9 \times 10^{-3}$$

MW-07 S/D

$$i_v = \frac{32.64 - 34.42}{22.04 - (-44.70)} = \frac{-1.78}{66.74} = -0.027 = -2.7 \times 10^{-2}$$

APPENDIX E

REMEDIAL DESIGN CALCULATIONS

ACCELERATED BIOREMEDIATION AMENDMENT DESIGN CALCULATIONS

Hydrodynamic Calculations

Treatment Area Volume					
Length	60	Ft			
Width	15	Ft			
Thickness of Treatment Zone	25	Ft			
Treatment Area Characteristics					
Soil Characteristics					
Soil Type (clay, silt, silty sand, sand, or gravel)	volcanic rock				
Bulk Density (rb)	2.75	g/cc			
	171.7	lbs/cu. Ft			
Fraction Organic Carbon (foc)	0.0001	(decimal)			
Hydraulic Characteristics					
Total Porosity (n)	0.60	(decimal)			
Effective Porosity (ne)	0.60	(decimal)			
Hydraulic Conductivity (K)	6.7	Ft/day			
	2.4E-03	cm/sec			
Hydraulic Gradient (i)	0.008	Ft/Ft			
Calculations					
Treatment Area	900	sq. Ft			
Treatment Volume	22,500	cu. Ft	=	637	cu. meters
Seepage Velocity (VX)	8.93E-02	Ft/day	=	32.61	Ft/yr
Total Pore Volume (VP)	13,500	cu. Ft	=	382	cu. meters

Biogeochemical Calculations

Dissolved Contaminant Demand	Concentration (mg/L)	Mass (kg)	Electrons Accepted (e- equiv/mol)	Electron Demand (e- equiv)	
Tetrachloroethene (PCE)	0.0019	0.0	8	0.0	
Trichloroethene (TCE)	0.703	0.3	6	12.3	(MW-07S)
cis-1,2-Dichloroethene (DCE)	0.494	0.2	4	7.8	
Vinyl Chloride	0.0992	0.0	2	1.2	

Sorbed Contaminant Demand	K_{oc} (L/kg)	Concentration (mg/kg)	Mass (kg)	Electrons Accepted (e- equiv/mol)	Electron Demand (e- equiv)
Tetrachloroethene (PCE)	230	0.0000	0	8	0.0
Trichloroethene (TCE)	87	0.0061	0	6	0.5
cis-1,2-Dichloroethene (DCE)	49	0.0024	0	4	0.2
Vinyl Chloride	30	0.0003	0	2	0.0

Background Demand	Concentration (mg/L)	Mass (kg)	Electrons Accepted (e- equiv/mol)	Electron Demand (e- equiv)	
Oxygen	0.49	0.2	4	23.4	
Nitrate	0.91	0.3	5	28.1	
Manganese	0.019	0.0	2	0.3	(MW-07S)
Iron	0.02	0.0	1	0.1	
Sulfate	52.4	20.0	8	1668.4	

Total Electron Demand			
Dissolved Contaminant Stoichiometric Electron Demand	=	21	e- equiv
Sorbed Contaminant Stoichiometric Electron Demand	=	1	e- equiv
Background Stoichiometric Electron Demand	=	1720	e- equiv
Total Stoichiometric Electron Demand	=	1,742	e- equiv
Metabolic Efficiency Factor (fe)	=	0.60	
Total Electron Demand	=	2,904	e- equiv

Amendment Calculations

Nutrient Amendments	Concentration (mg/L)	Mass (kg)	Electrons Donated (e- equiv/mol)	Electrons Generated (e- equiv)	
Sodium Lactate	225	86.0	12	9216.6	
Total Electrons Generated		=		9,217 e- equiv	3x FOS

Design Parameters

Injection Points		
Number of Injection Points	3	wells
Frequency of Injection (daily, weekly, monthly or quarterly)	quarterly	injections
Treatment Duration	3	months
Total Number of Injection Events	1	events
Injection Volume	1,000	gal
Nutrient Amendment		
Mass of Nutrients per Injection Point per Event		
Lactate	28.96	kg

Checked by: KHE

ACCELERATED BIOREMEDIATION AMENDMENT DESIGN CALCULATIONS

Hydrodynamic Calculations

Treatment Area Volume					
Length	60	Ft			
Width	15	Ft			
Thickness of Treatment Zone	10	Ft			
Treatment Area Characteristics					
Soil Characteristics					
Soil Type (clay, silt, silty sand, sand, or gravel)	silty sand				
Bulk Density (rb)	1.40	g/cc			
	87.4	lbs/cu. Ft			
Fraction Organic Carbon (foc)	0.001	(decimal)			
Hydraulic Characteristics					
Total Porosity (n)	0.30	(decimal)			
Effective Porosity (ne)	0.25	(decimal)			
Hydraulic Conductivity (K)	10.8	Ft/day			
	3.8E-03	cm/sec			
Hydraulic Gradient (i)	0.012	Ft/Ft			
Calculations					
Treatment Area	900	sq. Ft			
Treatment Volume	9,000	cu. Ft	=	255	cu. meters
Seepage Velocity (VX)	5.18E-01	Ft/day	=	189.22	Ft/yr
Total Pore Volume (VP)	2,700	cu. Ft	=	76	cu. meters

Biogeochemical Calculations

Dissolved Contaminant Demand	Concentration (mg/L)	Mass (kg)	Electrons Accepted (e- equiv/mol)	Electron Demand (e- equiv)	
Tetrachloroethene (PCE)	0.025	0.0	8	0.1	
Trichloroethene (TCE)	4.02	0.3	6	14.0	(TB-46-GW)
cis-1,2-Dichloroethene (DCE)	3.86	0.3	4	12.2	
Vinyl Chloride	0.742	0.1	2	1.8	

Sorbed Contaminant Demand	K_{oc} (L/kg)	Concentration (mg/kg)	Mass (kg)	Electrons Accepted (e- equiv/mol)	Electron Demand (e- equiv)
Tetrachloroethene (PCE)	230	0.0	0	8	0.1
Trichloroethene (TCE)	87	0.3	0	6	5.7
cis-1,2-Dichloroethene (DCE)	49	0.2	0	4	2.8
Vinyl Chloride	30	0.0	0	2	0.3

Background Demand	Concentration (mg/L)	Mass (kg)	Electrons Accepted (e- equiv/mol)	Electron Demand (e- equiv)	
Oxygen	0.57	0.0	4	5.4	
Nitrate	0.86	0.1	5	5.3	(MW-02S)
Manganese	0.079	0.0	2	0.2	
Iron	0.218	0.0	1	0.3	
Sulfate	49.8	3.8	8	317.1	

Total Electron Demand			
Dissolved Contaminant Stoichiometric Electron Demand	=	28	e- equiv
Sorbed Contaminant Stoichiometric Electron Demand	=	9	e- equiv
Background Stoichiometric Electron Demand	=	328	e- equiv
Total Stoichiometric Electron Demand	=	365	e- equiv
Metabolic Efficiency Factor (fe)	=	0.60	
Total Electron Demand	=	609	e- equiv

Amendment Calculations

Nutrient Amendments	Concentration (mg/L)	Mass (kg)	Electrons Donated (e- equiv/mol)	Electrons Generated (e- equiv)
Sodium Lactate	250	19.1	12	2048.1

Total Electrons Generated = 2,048 e- equiv 3x FOS

Design Parameters

Injection Points		
Number of Injection Points	3	wells
Frequency of Injection (daily, weekly, monthly or quarterly)	quarterly	injections
Treatment Duration	3	months
Total Number of Injection Events	1	events
Injection Volume per Well	1,000	gal
Nutrient Amendment		
Mass of Nutrients per Injection Point per Event		
Lactate	6.44	kg

Checked by: KHE

ACCELERATED BIOREMEDIATION AMENDMENT DESIGN CALCULATIONS

Hydrodynamic Calculations

Treatment Area Volume

Length	75	Ft
Width	40	Ft
Thickness of Treatment Zone	25	Ft

Treatment Area Characteristics

Soil Characteristics

Soil Type (clay, silt, silty sand, sand, or gravel)	silty sand	
Bulk Density (rb)	1.40	g/cc
	87.4	lbs/cu. Ft
Fraction Organic Carbon (foc)	0.001	(decimal)

Hydraulic Characteristics

Total Porosity (n)	0.30	(decimal)
Effective Porosity (ne)	0.25	(decimal)
Hydraulic Conductivity (K)	10.8	Ft/day
	3.8E-03	cm/sec
Hydraulic Gradient (i)	0.012	Ft/Ft

Calculations

Treatment Area	3,000	sq. Ft			
Treatment Volume	75,000	cu. Ft	=	2,124	cu. meters
Seepage Velocity (VX)	5.18E-01	Ft/day	=	189.22	Ft/yr
Total Pore Volume (VP)	22,500	cu. Ft	=	637	cu. meters

Biogeochemical Calculations

Dissolved Contaminant Demand	Concentration (mg/L)	Mass (kg)	Electrons Accepted (e- equiv/mol)	Electron Demand (e- equiv)	
Tetrachloroethene (PCE)	0.25	0.2	8	7.7	
Trichloroethene (TCE)	10.3	6.6	6	299.7	(TB-56-GW)
cis-1,2-Dichloroethene (DCE)	16.5	10.5	4	433.8	
Vinyl Chloride	1.42	0.9	2	29.0	

Sorbed Contaminant Demand	K_{oc} (L/kg)	Concentration (mg/kg)	Mass (kg)	Electrons Accepted (e- equiv/mol)	Electron Demand (e- equiv)
Tetrachloroethene (PCE)	230	0.1	0	8	8.2
Trichloroethene (TCE)	87	0.9	3	6	121.7
cis-1,2-Dichloroethene (DCE)	49	0.8	2	4	99.2
Vinyl Chloride	30	0.0	0	2	4.1

Background Demand	Concentration (mg/L)	Mass (kg)	Electrons Accepted (e- equiv/mol)	Electron Demand (e- equiv)	
Oxygen	0.40	0.3	4	31.9	
Nitrate	1.5	1.0	5	77.1	(MW-13S)
Manganese	0.253	0.2	2	5.9	
Iron	0.421	0.3	1	4.8	
Sulfate	106	67.5	8	5625.0	

Total Electron Demand

Dissolved Contaminant Stoichiometric Electron Demand	=	770	e- equiv
Sorbed Contaminant Stoichiometric Electron Demand	=	233	e- equiv
Background Stoichiometric Electron Demand	=	5745	e- equiv
Total Stoichiometric Electron Demand	=	6,748	e- equiv
Metabolic Efficiency Factor (fe)	=	0.60	
Total Electron Demand	=	11,247	e- equiv

Amendment Calculations

Nutrient Amendments	Concentration (mg/L)	Mass (kg)	Electrons Donated (e- equiv/mol)	Electrons Generated (e- equiv)
Sodium Lactate	625	398.3	12	42669.6

Total Electrons Generated = 42,670 e- equiv 3x FOS

Design Parameters

Injection Points

Number of Injection Points	8	wells
Frequency of Injection (daily, weekly, monthly or quarterly)	quarterly	injections
Treatment Duration	3	months
Total Number of Injection Events	1	events
Injection Volume per Well	250	gal

Nutrient Amendment

Mass of Nutrients per Injection Point per Event

Lactate	50.28	kg

Checked by: KHE

APPENDIX F

AMENDMENT INFORMATION AND MSDS

purac
pure by nature

Product data

Rev.No.8/3002

PURASAL® S

Description	PURASAL S is the sodium salt of natural L-Lactic acid, produced by fermentation of sugar. It has a mild saline taste, antimicrobial properties and is neutral by pH. PURASAL S is the ultra pure food grade sodium-L-lactate.	
Specification	Product	Sodium-L-lactate
	Form	liquid
Assay	Assay	58.8-61.2% w/w
	Assay sodium	12.1-12.6% w/w
	Density at 20°C	1.32-1.34 g/ml
Visual sensoric characteristics	Color fresh	max. 25 apha
Identification	Identification of sodium and lactate	passes test
	Stereochemical purity (L-isomer)	min. 97%
	Solubility in water	miscible with water
Purity	Acidity (as lactic acid)	max. 0.3% w/w
	Cyanide	max. 0.3 ppm
	Heavy metals total	max. 5 ppm
	Iron	max. 10 ppm
	Arsenic	max. 1.5 ppm
	Lead	max. 2 ppm
	Mercury	max. 1 ppm
	Citrate, oxalate, phosphate, tartrate	passes test
	Reducing substances	passes test
	Sugars	passes test
	Methanol and methyl esters	max. 50 ppm
	Chloride	max. 50 ppm
	Sulphate	max. 20 ppm
	Volatile fatty acids	passes test
	pH (direct)	7.8-8.3
	pH 1+5	6.5-7.5%, v/v
	pH 20	6.5-7.5%, v/v

purac
pure by nature

Product data

Rev.No.8/3002

Physical-chemical properties	Molecular formula	$CH_3CHOHCOONa$
	Molecular weight	112 (anhydrous)
	Chemical name	Sodium-L-2-hydroxy-propionate
Registration	CAS number	72-17-3
	EEC additive number	E 325
	USA	GRAS
	Complies with	FCC, EUSFAand JSFA

Packaging

PURASAL S is supplied in 210 L (55 gallon) polyethylene drums (275 kg, 606 lbs), 1000 L (264 gallon) semi-bulk containers (1315 kg, 2899 lbs) and bulk containers.

SAFETY DATA SHEET

Sodium-L- Lactate, PURASAL®S

REVISION DATE 07/03/00
REF. SD0130/us04

1. IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND THE COMPANY / UNDERTAKING

Product name	Sodium-L-Lactate, PURASAL® S	
Product code	3001-3008, 3501-3608	
Supplier	PURAC America, Inc. 111 Barclay Blvd. Lincolnshire, IL 60069 USA	PBR sínteses Praça Pio X, 15, 9° andar CEP 20.040-020 Rio de Janiero Brazil
Telephone	(847) 634 6330	++55 21 203 2191
Fax	(847) 634 1992	++55 21 263 9288
Emergency Telephone:	(800) 424 9300	++55 21 263 7292
Supplier	PURAC biochem Arkelsedijk 46 NL-4206 AC Gorinchem The Netherlands	Purac bioquimica Gran Vial 19-25 E 08160 Montmelo Barcelona Spain
Telephone	++31 (0) 183 695695	++34 93 572 1016
Fax	++31 (0) 183 695604	++34 93 568 3955
Emergency Telephone	++31 (0) 183 695695	++34 93 568 6300 (Ext 222)

2. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical name of the substance Sodium-L-(-)-2-hydroxy propionate aqueous solution.

Synonyms Sodium Lactate, Sodium-L(-)-2-hydroxy propionate

CAS-No. 867-56-1 **EC-No** 212-762-3

3. HAZARDS IDENTIFICATION

Most important hazards May cause eye irritation with susceptible persons.

4. FIRST AID MEASURES

General advice	Show this safety data sheet to the doctor in attendance.
Inhalation	Move to fresh air.
Skin contact	Wash off with plenty of water.
Eye contact	Rinse thoroughly with plenty of water, also under the eyelids.
Ingestion	Drink plenty of water.
Major effects of exposure	May cause eye irritation with susceptible persons.

For further information:

PURAC sales office:
PURAC America Lincolnshire, IL / USA Phone +1 847 634 6330 Fax +1 847 634 1992 e-mail pam@purac.com

SAFETY DATA SHEET

Sodium-L- Lactate, PURASAL®S

REVISION DATE 07/03/00
REF. SD0130/us04

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media	Water, carbon dioxide (CO_2), foam.
Extinguishing media which must not be used for safety reasons	None.
Specific hazards	Burning produces irritant fumes.
Special protective equipment for firefighters	None.
Specific methods	Standard procedure for chemical fires.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	Avoid contact with eyes. Use personal protective equipment.
Environmental precautions	No special environmental precautions required.
Methods for cleaning up	Flush with water.

7. HANDLING AND STORAGE

Handling	
Technical measures/Precautions	No special technical protective measures required.
Safe handling advice	Handle in accordance with good industrial hygiene and safety practice.
Storage	
Technical measures/ Storage conditions	Keep tightly closed in a dry place. Avoid long storage times.
Packaging material	Steel and plastic packages.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures to reduce exposure	Insure adequate ventilation, especially in confined areas.
Control parameters	None.
Personal protection equipment	
Respiratory protection	Not applicable.
Hand protection	Not applicable.
Eye protection	Safety glasses.
Skin and body protection	Not applicable.
Hygiene measures	Handle in accordance with good industrial hygiene and safety practice.

For further information:

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9. PHYSICAL AND CHEMICAL PROPERTIES

Form	aqueous solution
Color	light yellow
Odor	slight / none
pH	6.5 - 8.5 (10 - 60% aqueous solution) @ 77°F (25°C)
Molecular Weight	not applicable
Boiling point/range	221°F (105°C) (50% solution), 230°F (110°C) (60% solution)
Decomposition temperature	>392°F(200°C)
Autoignition temperature	not applicable
Flash point	not applicable
Explosion limits	not applicable
Density	1320 - 1340kg/m^3 @ 68°F (20°C) (60 % solution)
Solubility	Water solubility: completely soluble
Viscosity	80 - 160 mPa.s @ 68°F (20°C)

10. STABILITY AND REACTIVITY

Stability	Stable at normal conditions.
Materials to avoid	None.
Hazardous decomposition Products	Carbon oxides.

11. TOXICOLOGICAL INFORMATION

Acute toxicity	Health injuries are not known or expected under normal use. LD50/intraperitoneal/rat = 2000 mg/kg LD50/oral/rat = 2000 mg/kg.
Local effects	May cause eye irritation with susceptible persons.
Specific effects	Based on tests with L-lactic acid and its salts, there is **no** evidence to suggest carcinogenic nor mutagenic properties from lactic acid itself nor from the lactate portion of its metal salts.
Further information	Natural product in the body.

For further information:

PURAC sales office:
PURAC America Lincolnshire, IL / USA Phone +1 847 634 6330 Fax +1 847 634 1992 e-mail pam@purac.com

12. ECOLOGICAL INFORMATION

Mobility	Completely soluble in water.
Persistence / degradability	Product is a salt of lactic acid which is readily biodegradable.
Bioaccumulation	Unlikely.
Ecotoxicity	Ecological injuries are not known or expected under normal use.(No effect on Daphnia @ 10g/l.)

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products	Can be disposed as waste water, when in compliance with local regulations. Can be landfilled or incinerated, when in compliance with local regulations.
Contaminated packaging	Clean container with water. Empty containers should be taken for local recycling, recovery or waste disposal.

14. TRANSPORT INFORMATION

Not classified as dangerous in the meaning of transport regulations.

15. REGULATORY INFORMATION

US Regulations	TSCA Inventory Status: Y (Sodium Lactate) SARA III: N California Proposition 65: N Carcinogenic status: OSHA: N. NTP: N, IARC: N FDA: GRAS
EU Status	According to National equivalent of EC-Dir. 67/548, as amended, the product does not need to be labeled.

EU Food additive (Sodium Lactate E325)

For further information:

PURAC sales office:
PURAC America Lincolnshire, IL / USA Phone +1 847 634 6330 Fax +1 847 634 1992 e-mail pam@purac.com

16. OTHER INFORMATION

CAS-No. 72-17-3 (general) **EC-No** 200-772-0 (general)

NFPA Ratings (Scale 0-4) 0(health)-0(flammability)-0(reactivity)
HMIS Rating 0(health)-0(flammability)-0(reactivity)-A (protective equipment)

Further information on the safety assessment of sodium lactate and lactic acid can be obtained in a CFTA Report of June 6th 1997.

For further information:

PURAC sales office:
PURAC America Lincolnshire, IL / USA Phone +1 847 634 6330 Fax +1 847 634 1992 e-mail pam@purac.com

APPENDIX G

EQUIPMENT LITERATURE

Geoprobe Systems®

ENVIRONMENTAL · GEOTECHNICAL · GEOTHERMAL · EXPLORATION

E-Specs

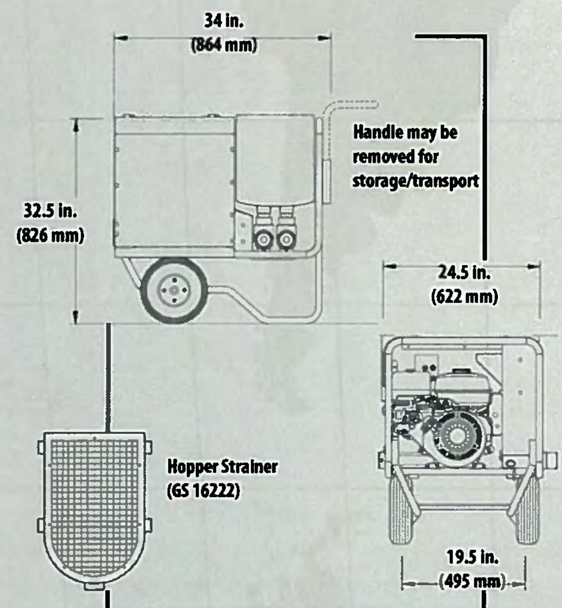
Geoprobe® GP300 Grout System

The GP300 Grout/Injection Machine was designed for the injection of remediation materials or for bottom-up grouting through small diameter probe holes. The GP300 is also capable of delivering standard ASTM grout mixes and provides operating pressure up to 1,300 psi with a maximum flow rate of 3.5 gpm.

- Designed for Injection of HRC® and HRC-X®
- Can Grout Probe Holes from the Bottom Up
- High Pressure enables Grouting by Small Tremie Tubes
- 9 hp Gasoline Engine
- Easy to Disassemble for Cleanup
- Dual Reciprocating-type Piston Pumps
- Few Replaceable (wear) parts
- Operates Independently of Direct Push Machine
- Use Without Carrier Vehicle Nearby
- Speed Control on Injection Machine
- Optional Viton seals for pumping harsh remediation materials

GP300 Specifications

Weight (without grout)	325 lb.	147 kg
Hopper Capacity	12.75 gal.	48.3 L
Hopper Capacity (3 in. freeboard)	9.5 gal.	36 L
Pump	Hydraulically-driven piston pump	
Hydraulic Power Source	Fixed displacement gear pump	
Hydraulic Power Source Engine	Honda Model GX270	
Hydraulic Reservoir Capacity	6.75 gal.	25.6 L
Engine Fuel Capacity	1.59 gal.	6.0 L
Engine Horsepower	9.0 hp gasoline	
Pump Displacement	13 cu. in.	213 mL
Pump Pressure Rating	1,300 psi	89 bar
Pump Flow Rate	0.9 - 3.5 gpm	3.4 - 13.3 Lpm



The GP300 has a marked 12.75 gallon hoper & is easily removed for cleaning

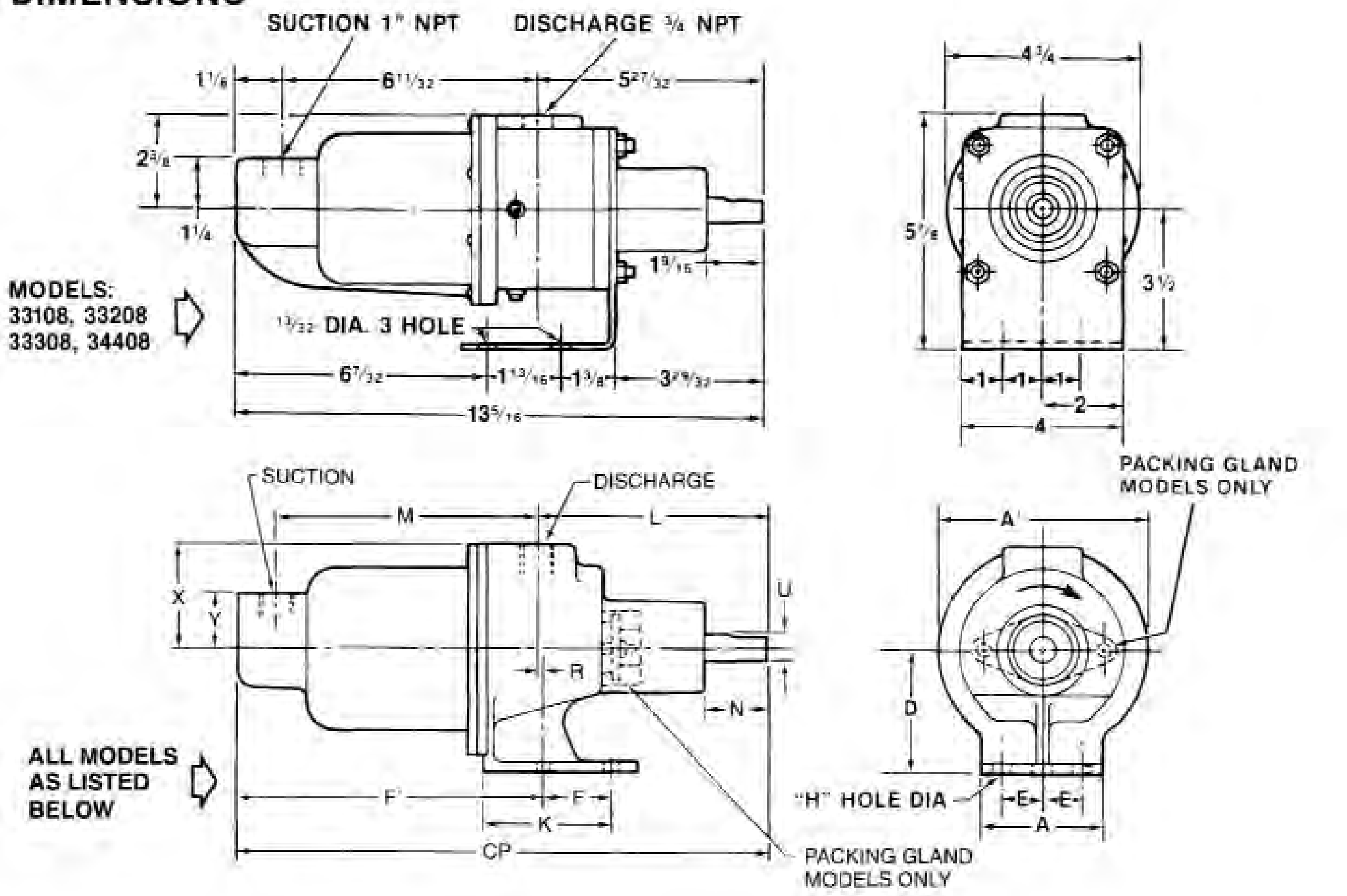
Speed Control Valve & Emergency Kill Switch

SPECIFICATION DATA

MOYNO® 500 PUMPS

300 SERIES
331, 332, 333, 344, 356 AND 367 MODELS

DIMENSIONS

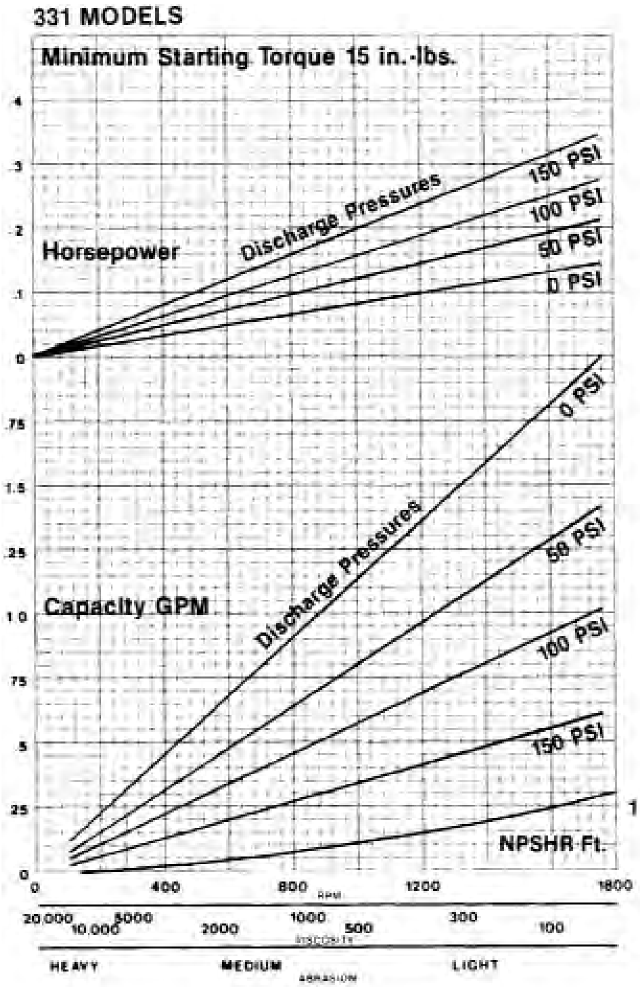


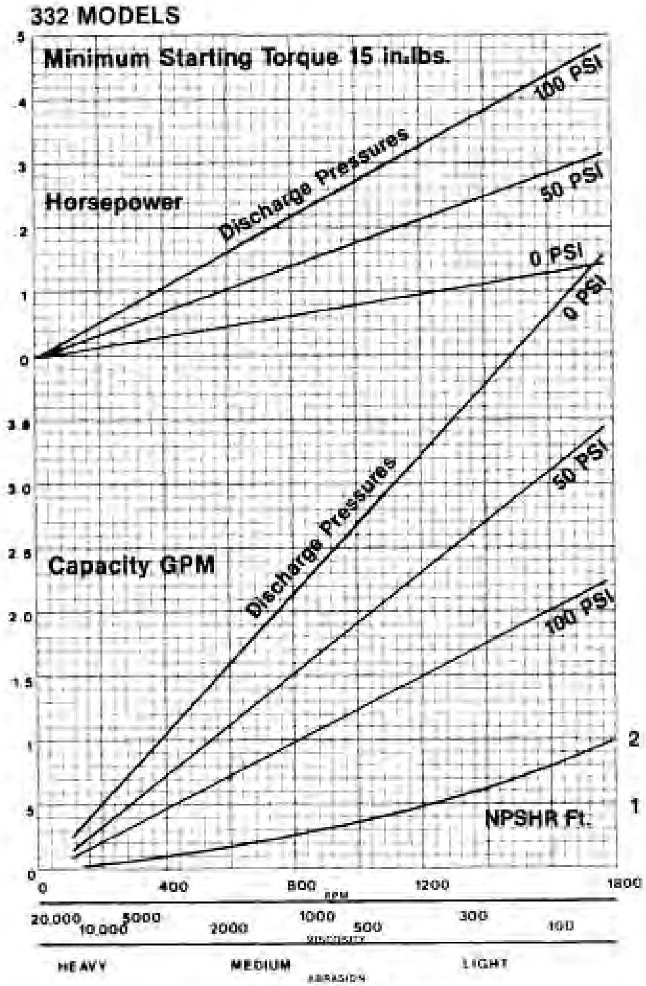
MODELS	CP	A	A^1	D	E	F	F^1	H	K	L	M	N	R	U	X	Y	SUCT (NPT)	DISCH (NPT)
33101, 33201 33301, 33104 33204, 33304 34401, 34404	$12\frac{5}{8}$	$3\frac{1}{8}$	$4\frac{3}{4}$	$2\frac{3}{4}$	1	$1\frac{13}{16}$	$6\frac{15}{16}$	$\frac{13}{32}$	$3\frac{1}{32}$	$5\frac{11}{16}$	$6\frac{1}{16}$	$1\frac{7}{16}$	—	$\frac{5}{8}$	$2\frac{3}{8}$	$1\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{4}$
*34411	$13\frac{15}{16}$	$3\frac{1}{4}$	$4\frac{3}{4}$	$2\frac{3}{4}$	$1\frac{1}{8}$	—	$7\frac{3}{16}$	$\frac{13}{32}$	$2\frac{7}{8}$	7	$6\frac{1}{16}$	$1\frac{3}{8}$	$\frac{1}{4}$	$\frac{5}{8}$	$2\frac{5}{16}$	$1\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{4}$
35601, 35604	$17\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{9}{16}$	$4\frac{9}{32}$	$1\frac{3}{4}$	2	$10\frac{19}{32}$	$\frac{13}{32}$	$4\frac{1}{2}$	$7\frac{3}{8}$	$8\frac{5}{8}$	$2\frac{3}{8}$	$\frac{15}{32}$	$\frac{3}{4}$	$3\frac{25}{32}$	$2\frac{1}{8}$	$1\frac{1}{2}$	$1\frac{1}{4}$
*35611, *35613	$19\frac{3}{8}$	$6\frac{1}{2}$	$7\frac{9}{16}$	$4\frac{9}{32}$	$1\frac{3}{4}$	$2\frac{1}{2}$	$10\frac{19}{32}$	$\frac{13}{32}$	4	$9\frac{11}{32}$	$8\frac{5}{8}$	$2\frac{13}{32}$	$\frac{9}{16}$	$\frac{3}{4}$	$3\frac{25}{32}$	$2\frac{1}{8}$	$1\frac{1}{2}$	$1\frac{1}{4}$
36701, 36704	$20\frac{15}{16}$	$5\frac{1}{4}$	8	$4\frac{1}{2}$	2	$2\frac{5}{16}$	13	$\frac{9}{16}$	$4\frac{1}{16}$	$7\frac{15}{16}$	$11\frac{3}{16}$	$2\frac{1}{8}$	—	1	4	$2\frac{1}{2}$	2	2

*Packing Gland Model

All dimensions are in inches. Specifications subject to change without notice.

331, 332, 333 and 344 MODELS
PERFORMANCE (water at 70ºF)



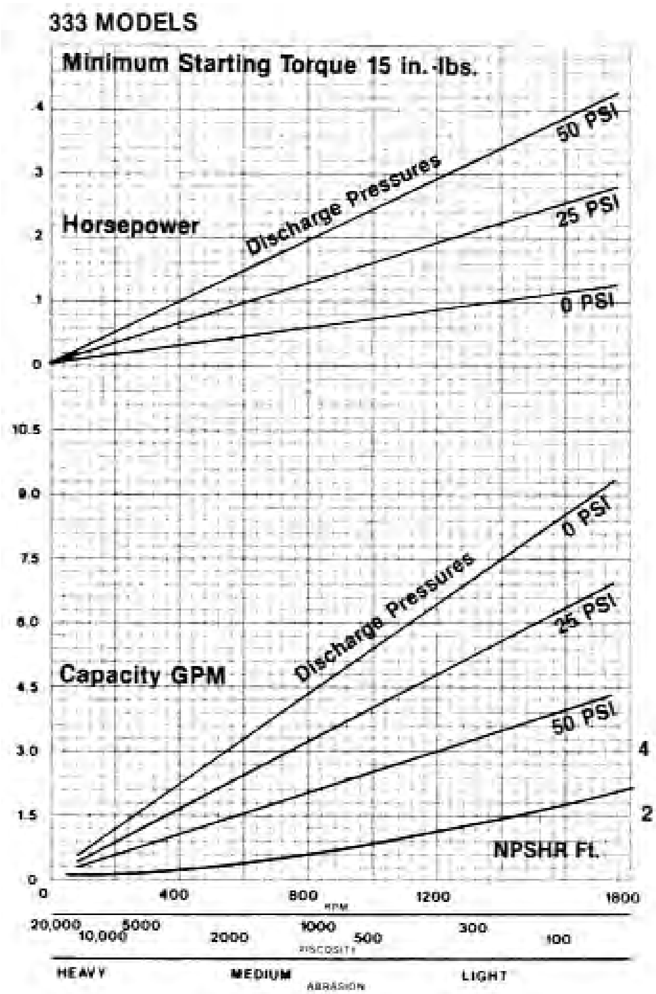


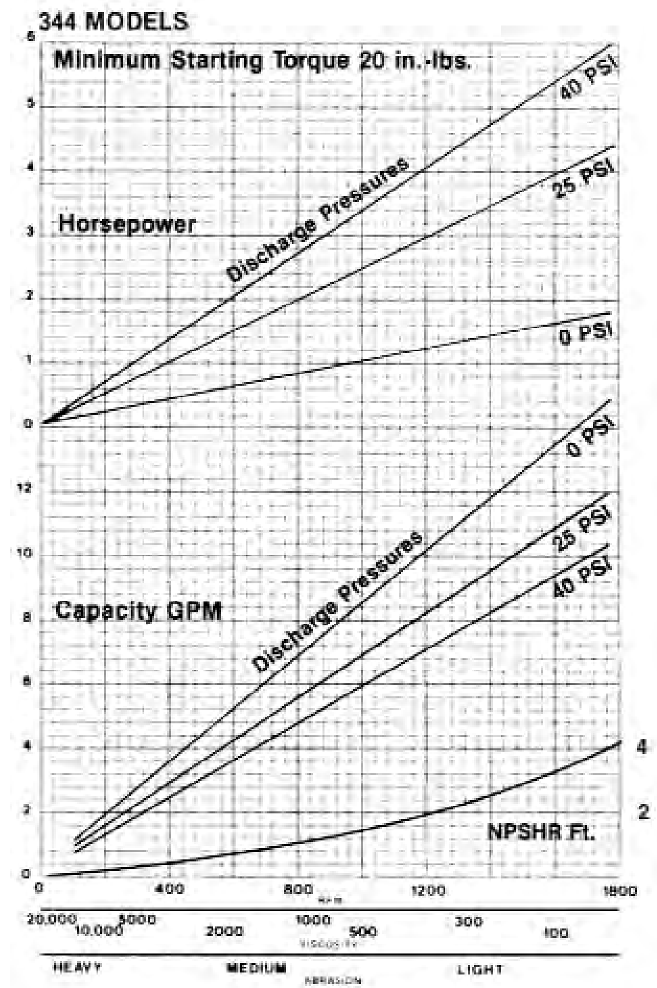
NOTE: For fluids with viscosity over 200 CP (1000 SSU), pump capacity is reduced by 20%.

MATERIALS OF CONSTRUCTION

COMPONENT	MODELS			
	33101, 33201 33301, 34401	**33104, 33204 33304, 34404**	**33108, 33208 33308, 34408**	***34411**
Housing	Cast iron	316 SS	Nylon	Cast iron
Rotor	416 SS/CP	316 SS/CP	416 SS/CP	416 SS/CP
Stator	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)
Weight (lbs)	16	16	8	16

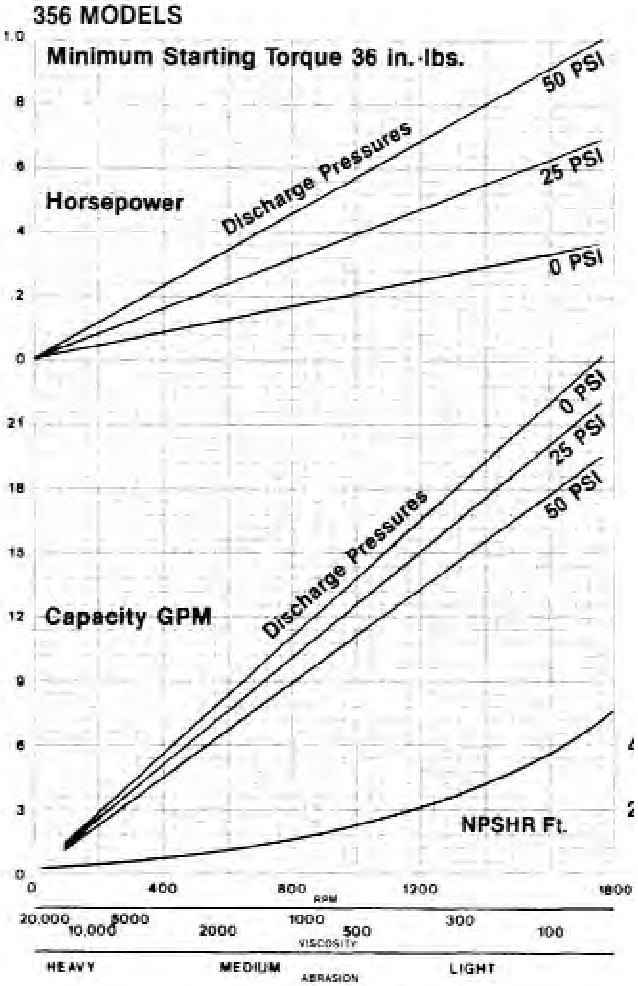
* Packing Gland Model
CP = Chrome plated

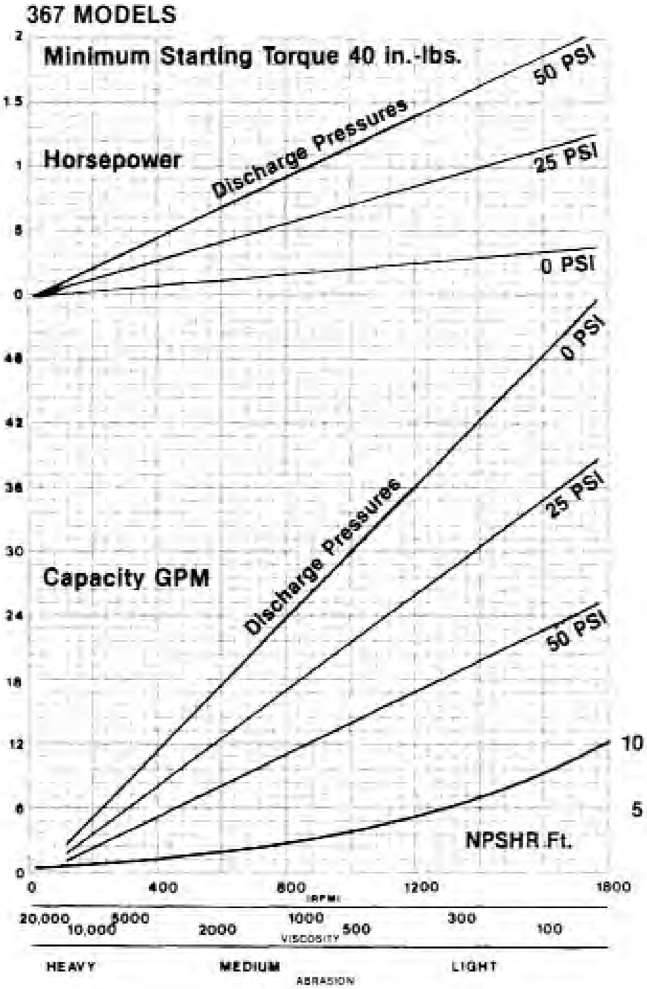




NOTE: For fluids with viscosity over 200 CP (1000 SSU), pump capacity is reduced by 20%.

356 and 367 MODELS PERFORMANCE (water at 70°F)





NOTE: For fluids with viscosity over 200 CP (1,000 SSU), pump capacity is reduced by 20%.

MATERIALS OF CONSTRUCTION

<table>
<tr><th rowspan="2">COMPONENT</th><th colspan="6">MODELS</th></tr>
<tr><th colspan="2">35601, 35611</th><th colspan="2">35604, 35613</th><th>36701</th><th>36704</th></tr>
<tr><td>Housing</td><td colspan="2">Cast iron</td><td colspan="2">316 SS</td><td>Cast iron</td><td>316 SS</td></tr>
<tr><td>Rotor</td><td colspan="2">416 SS/CP</td><td colspan="2">316 SS/CP</td><td>416 SS/CP</td><td>316 SS/CP</td></tr>
<tr><td>Stator</td><td colspan="2">NBR (Nitrile)</td><td colspan="2">NBR (Nitrile)</td><td>NBR (Nitrile)</td><td>NBR (Nitrile)</td></tr>
<tr><td>Weight (lbs)</td><td>37</td><td>40</td><td>37</td><td>40</td><td>54</td><td>54</td></tr>
</table>

CP=Chrome plated